NOVEMBER 14, 1958

electronics

business issue

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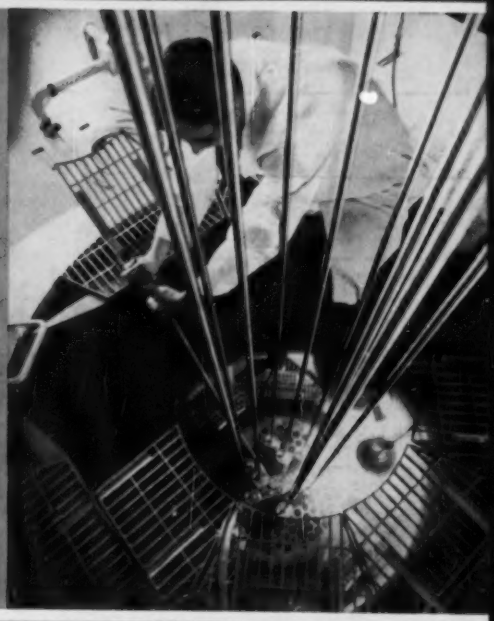
Our Future In Nuclear Power

Here's a close-up of what it takes to control a new atomic reactor . . p 13



Outfitting Jet Airliners

Radio, navigation and other gear makes a $150,000 electronic package . . p 20

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Shoptalk . . .

One Best Bet in 1959

Beginning in January, ELECTRONICS will have the same editorial format each week.

Technical articles that have distinguished the magazine since 1930 as the leading publication in its field will be increased in number and will be joined by business articles we now know have wide appeal and usefulness.

We learned in 1957 that there was a need for this additional material; we learned in 1958 that it was needed weekly. So our planned standardization of issues should better serve readers in research, design, production and management. And we hope it will make ELECTRONICS compulsory reading for many others.

Subscribers gained 400 additional editorial pages in 1957, more than 550 in 1958. They will benefit again in the year just ahead, both in quantity and in quality, as we further broaden our scope and coverage without taking our eye off the engineering ball.

Thus ELECTRONICS keeps pace with its growth industry. If it's about electronics, read it in ELECTRONICS—repackaged as a straight weekly.

H W Matern

Publisher

About Our Current Operations . . .

In this Issue . . . . .

NUCLEAR POWER: WHAT IT MEANS TO US—It takes a heap of electronic equipment to control a nuclear reactor. To find out how much and what kind, Managing Editor Carroll climbed over the Westinghouse Testing Reactor now under construction near Pittsburgh. His tally of the electronic gear in the WTR, together with some observations on the size, shape and future of the electronics market in the nuclear power field, begins on p 13.

MACHINE TOOL CONTROL—Two weeks ago Associate Editor Janis took us overseas for a glimpse of industrial electronics abroad. Together with field editors Hood, Harris and Maguire, he brings you up to date this week on what is going on here at home. See p 15.

Coming In Our November 21 Issue . . .

ELECTRONICS ON WHEELS—Automobile manufacturers are readying several electronic surprises for the motoring public. To get details on things like rear-view tv steering controls, radar warning devices and electronic ignition, Associate Editor Bushor visited the Detroit laboratories. His seven-page technical roundup, with circuits, of course, will appear next week.

An Editorial Future for You?

THE NEW EDITORIAL FORMAT described on the other side of this page will substantially increase ELECTRONICS' engineering feature article content. Accordingly, openings now exist on the staff for engineering editors. If you have a degree in electrical engineering with a concentration in electronics, a year or so of experience in our industry, an insatiable curiosity about new circuits, components and systems and ability to write, edit and report technical developments, Editor MacDonald would like to talk with you about a future on the magazine.

electronics business issue

A McGRAW-HILL PUBLICATION • VOL. 31, NO. 46 • NOVEMBER 14, 1958

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Issue at a Glance

Electronics R&D. All U.S. industry spent $1.4 billion on R&D electronics, National Science Foundation finds.....p 5

Shares and Prices. Typical R&D-to-sales ratios.....p 5

Mergers, Acquisitions and Finance.....p 6

Figures of the Week.....p 6

Washington Outlook .....p 8

Executives in the News. Smith of General Railway Signal.....p 10

Comment .....p 10

Our Future in Atomics. Checking reactor design for Yankee Atomic Power Plant shows uses of atomic power are growing rapidly. Need for electronic control and instrumentation of reactors presents opportunity and challenge .....p 13

Production and Sales. Hi-Fi Component Sales Setting Record.....p 14

Tooling Up Electronically. International and domestic space age competition put pressure on U.S. industry to accelerate use of electronic controls for machine tools and assembly lines.....p 15

Outfitting New Jet Airliners. Electronics package for each plane may come to $150,000 .....p 20

New England Eyes R&D Payoff. Big show next week sparks push for sales upswing. Northeast area firms see '59 and '60 as key growth years. Engineering-in-depth, strong position in military electronics, buoy optimism .....p 23

Electronic Warfare. Navy's new $7-million training system is an electronic eye opener .....p 23

DIGEST CONTINUED ON NEXT PAGE

DIGEST continued

Engineering Report ..... p 25

Sees Boom in Diffused Silicon Transistors — Technical Digest
Electronic Scan Ups Radar Range — Meetings Ahead
Moon Probe Carries Electronics Package

Components and Materials ..... p 28

Easy-Matching Contact — Barium Titanate Measures Heat
Printed Circuits Getting Smaller — New Plastic in Pilot Production

Navy Unveils War Simulator. Multimillion-dollar complex of computers and communications helps train future commanders ..... p 30

Military Electronics ..... p 30

Contracts Awarded ..... p 30

New Products ..... p 33

Literature of the Week ..... p 43

Red China: A Line on Science. Chinese Communists cite advances in electronics. They claim party thinking, not USSR, brings progress ..... p 44

Developments Abroad ..... p 44

Exports and Imports ..... p 44

Broadcast Stereo Increases. Two-channel transmission systems are being developed by broadcasters to expand national stereo interest ..... p 46

FCC Actions ..... p 46

Station Moves and Plans ..... p 46

Plants and People ..... p 49

News of Reps ..... p 52

Index to Advertisers ..... p 52

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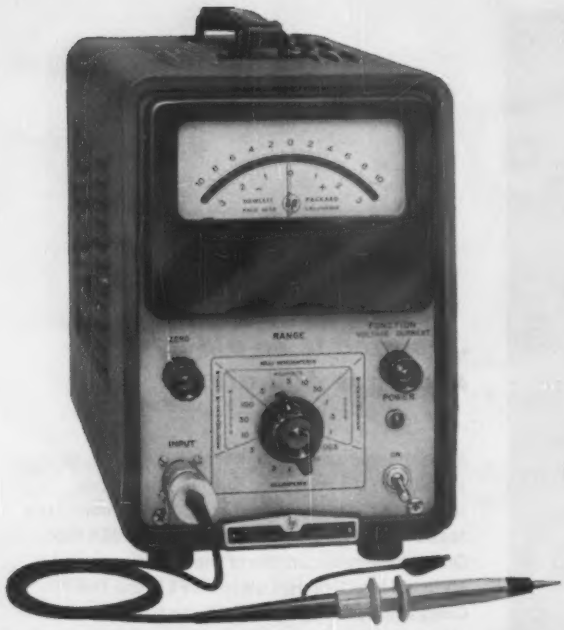

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Electronics R&D

All U.S. industry spent $1.4 billion on R&D electronics, latest survey figures show

THERE'S NEW EVIDENCE this week that electronics technology spreads across all of American industry.

According to latest available information, all U.S. industry in 1956 spent $1.4 billion on electronics research and development. And of this amount, a little more than half—some $670 million—was spent by the electronics-electrical industries group.

As for total spending by everyone on all types of research, the newest figure is an impressive $6.5 billion.

This information comes from a survey made by the Bureau of Labor Statistics for the National Science Foundation.

Pinpointing precisely the electronics industry's share of R&D spending is a bit difficult. Our industry does not have its own category among industry classifications. In the new BLS survey, electronics is reported in the electronic-electrical systems and parts category.

The R&D expenditures listed on the right represent only applied research and development projects directed toward discoveries which have specific commercial objectives. The list excludes basic research made solely to advance scientific knowledge.

Electronics industry leaders say the survey points to the many new electronic products and processes that are on the way. Applied electronics portion of all research and development spending in 1956 was a staggering 21.6 percent.

A breakdown of survey findings on electronic applied research expenditures by industry groups follows:

INDUSTRY	Applied R&D Expenditures For Electronics (millions of $)
Electronic-Electrical Systems, Parts	$ 669.6
Aircraft and Associated Parts	260.7
Machinery (including computers)	182.1
Telecommunications and Broadcasting	137.0
Professional & Scientific Instruments	64.5
Fabricated Metal Products and Ordnance	36.7
Stone, Clay and Glass Products	4.4
Food and Kindred Products	4.0
Textile Mill Products and Apparel	1.1
Petroleum Products and Extraction	.8
Primary Metals	.8
Chemicals and Allied Products	.4
Transportation and Other Public Utilities	.3
Construction	.1
Paper and Allied Products	.1
All Other Industries	30.3
Total	$1,392.9

National Science Foundation does not have any figures at this time on applied electronics R&D spending subsequent to 1956. It hopes to make this information available in the future.

Meanwhile, estimates of all research and development spending by industry provides a rough guide.

McGraw-Hill's Department of Economics has recently estimated that industry spent $7.3 billion on applied and basic research in 1957, will spend $8.3 billion in 1958 and nearly $10 billion by 1961.

It seems conservative to assume that the electronics applied research portion of the above estimates will at least equal the 21.6 percentage relationship that existed in 1956.

SHARES and PRICES

ONE OF THE questions most frequently asked of electronics firm execs speaking before investment groups is: What percentage of your sales dollar are you spending on research and development?

Reason is that investment bankers and brokers know from experience that it is no accident that companies with the largest growth percentage are those which place great emphasis on development of new products.

Statistics show that industries with the highest growth rate are those which spent the highest percentage of their sales dollar on research and development.

The registration statements filed by firms with the SEC preliminary to making new security issues is often a fruitful source for company R&D spending figures. The following table has been compiled from this and other sources.

Some Electronics M'frs Providing Data On R&D Expenditures	Approximate R&D Spending (% of Sales)	12-Mo Sales (Latest Annual Report)	12-Mo Earnings Per Share (Latest Annual Report)	Common Stock Prices Recent	'58 Range	Traded
Addressograph-Multigraph	2.6	$97,100,000	$3.25	86	82 -94	NYSE
Amphenol Electronics	3.0	31,100,000	3.02	30¼	22⅜-32¼	NYSE
General Electric	over 6.0	4,335,700,000	2.84	65¾	57 -68¾	NYSE
International Tel. & Tel.	3.0	576,500,000	3.12	51	29¼-53¾	NYSE
D. S. Kennedy	10.0	5,800,000	1.80	21¾[2]	21¼-25¼	OTC
Sanborn	6.0	12,300,000[1]	1.14[1]	26[2]	16 -27½	OTC
Technology Instrument	4.8	6,800,000	1.01	9½[2]	9½-12¾	OTC
Westinghouse Electric	10.0	2,009,000,000	4.18	66½	55½-68¼	NYSE

[1] Ten months ending Jan. 31 [2] bid

MERGERS, ACQUISITIONS and FINANCE

• **Aircraft Radio** of Boonton, N. J., and **Cessna Aircraft**, Wichita, Kan., announce merger plans. Proposed plan calls for three shares of AR to be exchanged for two shares of Cessna. AR common was recently quoted at 26 over-the-counter; at same time Cessna closed at 53 on NYSE. Boonton firm has 312,000 shares outstanding. Cessna will exchange on basis of 845,000 shares, to be outstanding after payment of 10-percent stock dividend due Dec. 19.

Two previously announced plans to merge AR—with **Litton Industries** and **Airborne Instruments**—were broken off in the latter stages of negotiation. No changes in Aircraft Radio management and operations are anticipated.

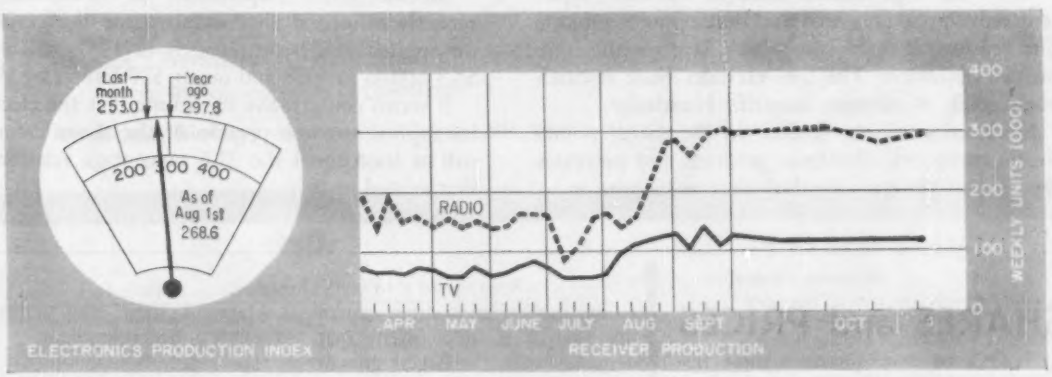
AR makes electronic airborne communication and navigation equipment. Annual sales are at rate of $10 to $11 million, with 60 percent going to military users and 40 percent to commercial. Cessna produces personal planes, military liaison aircraft and farm equipment pumps. Sales for year ended Sept. were about $86 million and were equally divided between military and industrial business.

• **Automation Instruments,** Pasadena, Calif., plans to issue $250,000 of 6-percent 15-year convertible debentures. They will be offered to firm's stockholders at 90 percent of face value and in $100, $500 and $1,000 units. Debentures are convertible at rate of one common share for each $100 of debentures. Proceeds will be used to retire notes payable and for working capital. Firm makes solenoids, transformers.

• **A-S-R Products,** formerly **American Safety Razor Corp.,** acquires all capital stock of **U. S. Relay Co.,** Los Angeles, Calif. U. S. Relay makes electronic relays, solenoid contactors and electronic controls. Purchase terms provide for a cash payment, plus a participation by the sellers in profits.

• **Precise Development** of Oceanside, Long Island, N. Y., issues 60,000 shares of convertible preferred and 60,000 shares of common stock at $5 per unit of one share of preferred and one share of common. Oceanside firm makes hi-fi and stereo equipment, electronic test equipment and diverse line of electronic components. It is developing a line of small-boat electronic equipment. Proceeds will be used to reduce bank loans and for payment of taxes, to purchase materials and for new product design expenses. If entire issue is sold, about $160,000 will be added to working capital. R. A. Holman & Co. of New York is handling the underwriting on a best-efforts basis.

• **Hewlett-Packard** agrees to acquire 80 percent of the outstanding stock of **F. L. Moseley Co.** of Pasadena, Calif. Moseley manufactures a line of recorders and associated electronic instruments.



FIGURES OF THE WEEK

RECEIVER PRODUCTION

(Source: EIA)	Oct. 24, '58	Oct. 17, '58	Oct. 25, '57
Television sets, total	121,267	124,503	169,806
Radio sets, total	310,148	287,829	401,178
Auto sets	75,073	93,088	125,813

STOCK PRICE AVERAGES

(Source: Standard & Poor's)	Oct. 29, '58	Oct. 22, '58	Oct. 30, '57
Radio-tv & electronics	62.99	61.21	42.32
Radio broadcasters	73.39	74.08	53.00

FIGURES OF THE YEAR

Totals for first eight months

	1958	1957	Percent Change
Receiving tube sales	251,657,000	297,281,000	—15.3
Transistor sales	25,310,834	15,611,300	+62.1
Cathode-ray tube sales	4,952,862	6,236,890	—20.6
Television set production	2,950,455	3,756,533	—21.5
Radio set production	6,611,686	8,765,606	—24.6

LATEST MONTHLY FIGURES

EMPLOYMENT AND EARNINGS

(Source: Bur. Labor Statistics)	Aug. '58	July, '58	Aug. '57
Prod. workers, comm. equip.	354,900	340,600	409,800
Av. wkly. earnings, comm.	$82.39	$80.75	$77.81
Av. wkly. earnings, radio	$81.40	$80.39	$75.81
Av. wkly. hours, comm.	39.8	39.2	39.9
Av. wkly. hours, radio	39.9	39.6	39.9

TRANSISTOR SALES

(Source: EIA)	Aug. '58	July '58	Aug. '57
Unit sales	4,226,616	2,631,894	2,709,000
Value	$9,975,935	$6,598,762	$6,598,000

TUBE SALES

(Source: EIA)	Aug. '58	July, '58	Aug. '57
Receiving tubes, units	30,456,000	30,795,000	43,029,000
Receiving tubes, value	$25,442,000	$26,927,000	$34,886,000
Picture tubes, units	713,458	549,817	930,296
Picture tubes, value	$14,190,878	$11,109,048	$17,984,185

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WASHINGTON OUTLOOK

THE ADMINISTRATION has expressed disagreement with proposals from the Army and some diplomatic officials for a sweeping revision of U.S. defense strategy with a new emphasis on preparedness for limited warfare.

The policy-shift proposal would have involved at least doubling current production of ground communications and radar gear, armored vehicles, troop transport planes, assault transport vehicles, small arms, tactical missiles and other weapons for limited warfare.

Proponents of limited warfare preparedness have pointed to the crises in Lebanon and the Formosa Straits as evidence that this country is more seriously threatened by limited wars than by a general nuclear war involving major powers.

They argue that recent defense budgets have put too much stress on preparedness for the big nuclear threat—with the heaviest spending devoted to the Strategic Air Command—and have downgraded U.S. capabilities for fighting a limited war.

The Administration, however, holds that U.S. defense forces are now ready to fight either limited or general wars. The Administration plans no significant shift in either strategic policy or the makeup of the defense budget.

Washington's official line was aired by the Joint Chiefs of Staff chairman, Air Force Gen. Twining, before the annual meeting of the Association of the U.S. Army.

Twining said it is risky to assume that the threat of one kind of war is more serious than another, then put the Administration's plans into perspective: the Army will not be allowed to substantially increase expenditures for armor and other tactical equipment; the Air Force will not step up procurement of troop carrier planes.

The Army will be limited to its current $1.3-billion volume of hardware procurement. The Army will be pressured out of the space rocket field and forced to use its available dollars for improving mobility of its battlefield missiles and other equipment.

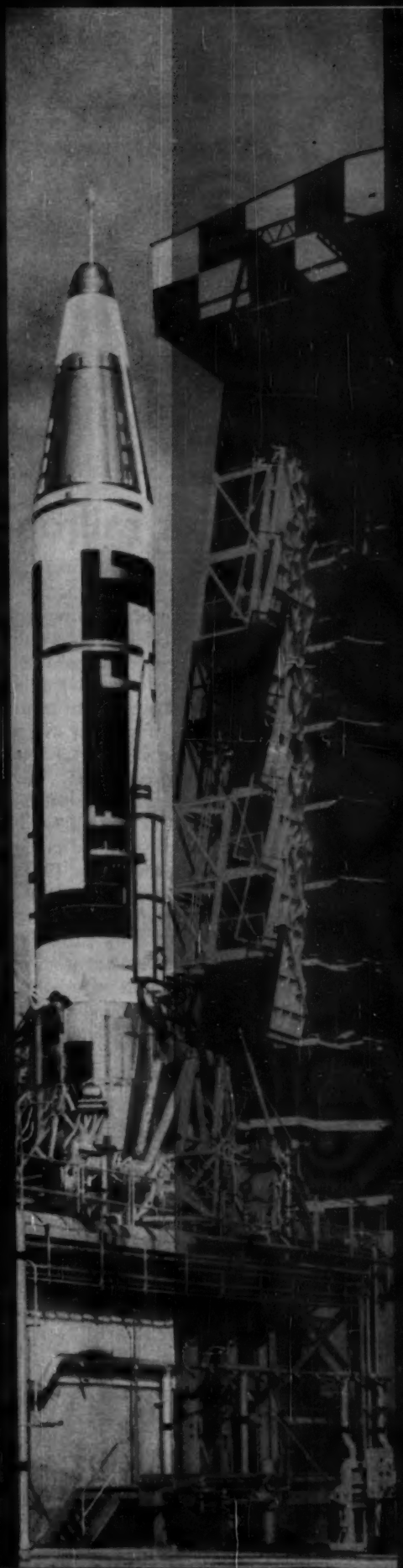
- **The spotlight** is once more on the controversial Renegotiation Act. Trial has just closed in U.S. Tax Court in Seattle on Boeing's appeal from the Renegotiation Board's ruling that the company must refund to the government $10 million gross profits earned in 1952.

The court is not likely to rule on Boeing's appeal for a year. But the trial was pretty much of a test case for the aircraft industry and other military producers. It's the first of a series of pending aircraft renegotiation appeals to be heard. At least six other airframe makers have filed appeals for recovery of at least $50 million before taxes, refunded to the government under renegotiation proceedings.

Boeing's argument stressed that $5.8 million of its 1952 profits before taxes came from incentive-type production contracts, that in effect the Renegotiation Board is penalizing the company for its efficiency.

U.S. lawyers said renegotiation determinations of excessive profits are made, under law, on all company receipts for the year, and that incentive-type contracts are not exempt from the Board's rulings.

READINESS IS THE KEY!



All is in readiness. The gantry is being rolled away. This missile is ready for its journey into space.

But before the firing could take place, the entire launching complex had to be made ready to accommodate the missile in its present configuration. In the hours, days, and weeks that have preceded this moment, an intensive "make ready" program has been progressing quickly, logically, economically—guided by the engineers of Pacific Automation Products, Inc.

BROADLY, ours has been a dual role—to provide technical and practical liaison between the engineering departments of the cognizant contractors and their field forces, and to install and validate all of the electronic gear that is required to convert this launch site from a mass of concrete and steel into an integrated complex, ready to support the scheduled firing of the bird.

SPECIFICALLY — our tasks have included: design, manufacture, and installation of all interunit cabling; the installation of instrumentation, controls, communications equipment, consoles, and accessories; actual operation of all circuitry under simulated conditions of use, to make certain that it is ready to perform its functions reliably; and documentation of the system in the form of working drawings, maintained in an up-to-the-minute status at all times.

SIGNIFICANTLY — to assure on-schedule readiness of an electronic complex—whether it be at a MISSILE SITE, AN AUTOMATIC FACTORY, A DATA PROCESSING CENTER, A NUCLEAR INSTALLATION—plan today to utilize the systems engineering services of Pacific Automation Products, Inc. For complete information, write, wire, or phone Arthur P. Jacob, Executive Vice President, PACIFIC AUTOMATION PRODUCTS, INC., 1000 Air Way, Glendale 1, California. Phone CHapman 5-8661.

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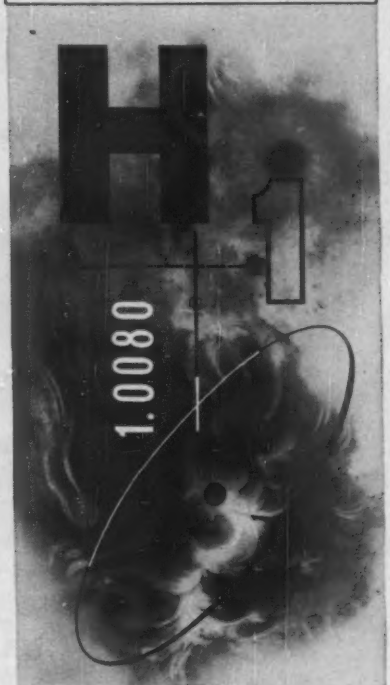

Hydrogen! Lightest of all elements . . . part of all living things! Cog in the nation's weapon-missile program!

Hydrogen fills Tung-Sol/Chatham thyratron tubes used in tracking beacons and radar modulators—two means of missile observation. The tubes provide the power for the signals or "beeps" that describe to us missile flight behavior.

Miniature types pulse "beeps" from airborne missiles. "Beeps" pulsed by giant thyratrons in ground units, resound from missiles in flight.

Hydrogen thyratrons—exclusive Tung-Sol/Chatham development—supply the premium quality performance critically needed in missile experiments. Over the years, Tung-Sol consistently has woven a thread of similar quality throughout its products. So, today, the Tung-Sol mark remains a symbol of the finest.

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Quality Electronic and Automotive Components

CIRCLE 6 READERS SERVICE CARD

EXECUTIVES IN THE NEWS

Smith: for railroads, a new Rx

NEW PRESIDENT of General Railway Signal Co. is Percy W. Smith, engineer and salesman up from the ranks. He takes over the Rochester, N. Y., firm at a time when its principal industry customer is in a state of flux, faces a rough challenge cheerfully.

Railroads, trying to haul themselves into reasonable financial stability, are using electronics as one of many bootstraps. Today's yard control system—with pushbutton remote control, analog computer gear and almost automatic operation—may use upwards of 2,000 electron tubes. Transistors are coming in, too: GRS has been installing transistorized cab-signal circuits since early 1955. "Pat" Smith's first order of business as he settles into his new office will be marshalling GRS engineering talent—some one-fifth of its total work force—for a frontal assault on traffic problems: railroad, air and others.

Born in Springville, N. Y., in 1900, Smith grew up in the nearby railroad town of Salamanca, naturally gravitated to railroading at an early age. Before he turned 20 he was working for the old Buffalo, Rochester & Pittsburgh (now part of the B&O system). He broke in as an engine dispatcher, simultaneously kept up his schooling.

He missed what he still regards as "the privilege of conventional college attendance," but found time for numerous technical courses at Rochester Institute of Technology's night school. In 1923 he went to work in the engineering department of GRS, slipped naturally into engineering sales a few years later.

His native talent for getting along with engineering staff, sales associates and clients moved him right up the line into management. He contrives to be a firm-handed administrator without mashing toes, remains friendly and accessible even under pressure. He became a vice president in 1950, moved into the top slot late last month.

Like most far-ranging salesmen, Smith is a homeloving man at heart. His wife Dorothy shares with him his principal interest outside of GRS: growing roses, a particularly suitable hobby in Rochester, long noted as the Flower City.

COMMENT

Consumer Electronics

Two of your recent stories—the Washington Outlook for Oct. 31 and the consumer electronics story in the Oct. 17 issue ("Home Stretch Looks Good," p 15, Oct. 17) skirted around a highly sensitive subject. The Outlook mentions "low volume of consumer elec-

tronics production during the first six months" of 1958. Down at the bottom of the earlier article, you quote a "thoughtful California manufacturer" as recognizing that people want their purchases to have inherent value.

I'm sure the two things are related. As long as consumers have money to throw away, they're reasonably content (apparently) to spend it on bright, gaudy products that maybe work and maybe won't. But when the pinch comes, they demand higher quality for dollars expended.

Some of our designers and production people ought to sit down and reconsider what a radio or phonograph or tv is, what it's supposed to do, and how it can best do its job. Simplicity, taste and a greater emphasis on reliability might just spark a general renascence in radio-tv sales.

STEWART FABREGA
PHILADELPHIA

The out-of-the-saddle survey of radio-tv manufacturers that we took to get the information for the consumer electronics article specifically asked whether manufacturing and sales executives felt that consumer taste was changing. The general consensus was no.

A Very Long Time

Re your Oct. 17 air-to-air missile story ("Fighter Arms Stockpile Swells," p 13, Oct. 17), particularly as the Falcon GAR-3 and Sidewinder: isn't 45 years a pretty long development period? J. H. Hammond and I demonstrated such target-seeking missile principles to military officials in 1912.

Also as to the item "Soviet information retrieval . . ." (Engineering Report, p 21, Oct. 17), Stephen Leacock's *Nonsense Novels*, Chapter 6 (1913) is captioned: "Sorrows of a Super Soul; or The Memoirs of Marie Mushenough (translated by Machinery, out of the Original Russian)"!

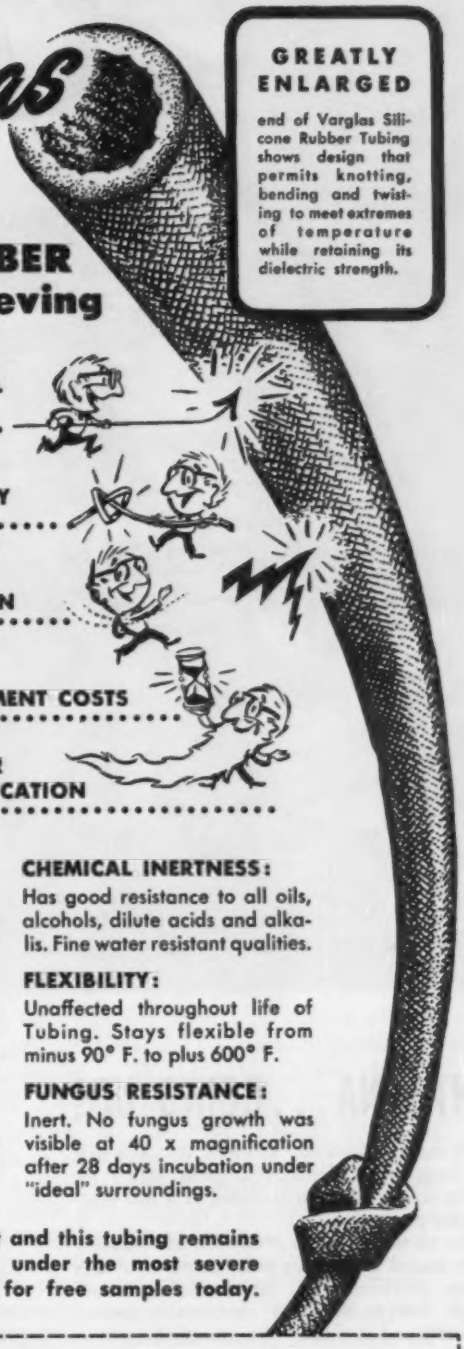
B. F. MIESSNER
MORRISTOWN, N. J.

As the Preacher said: "There is no new thing under the sun."

5 Ways Better...

Varglas

SILICONE RUBBER
Tubing and Sleeving



GREATLY ENLARGED
end of Varglas Silicone Rubber Tubing shows design that permits knotting, bending and twisting to meet extremes of temperature while retaining its dielectric strength.

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2 GREATER FLEXIBILITY

3 HIGH DIELECTRIC RETENTION

4 LONG LIFE CUTS REPLACEMENT COSTS

5 VIVID COLORS FOR READY IDENTIFICATION

THERMAL PROPERTIES:
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FLAMMABILITY:
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FLEXIBILITY:
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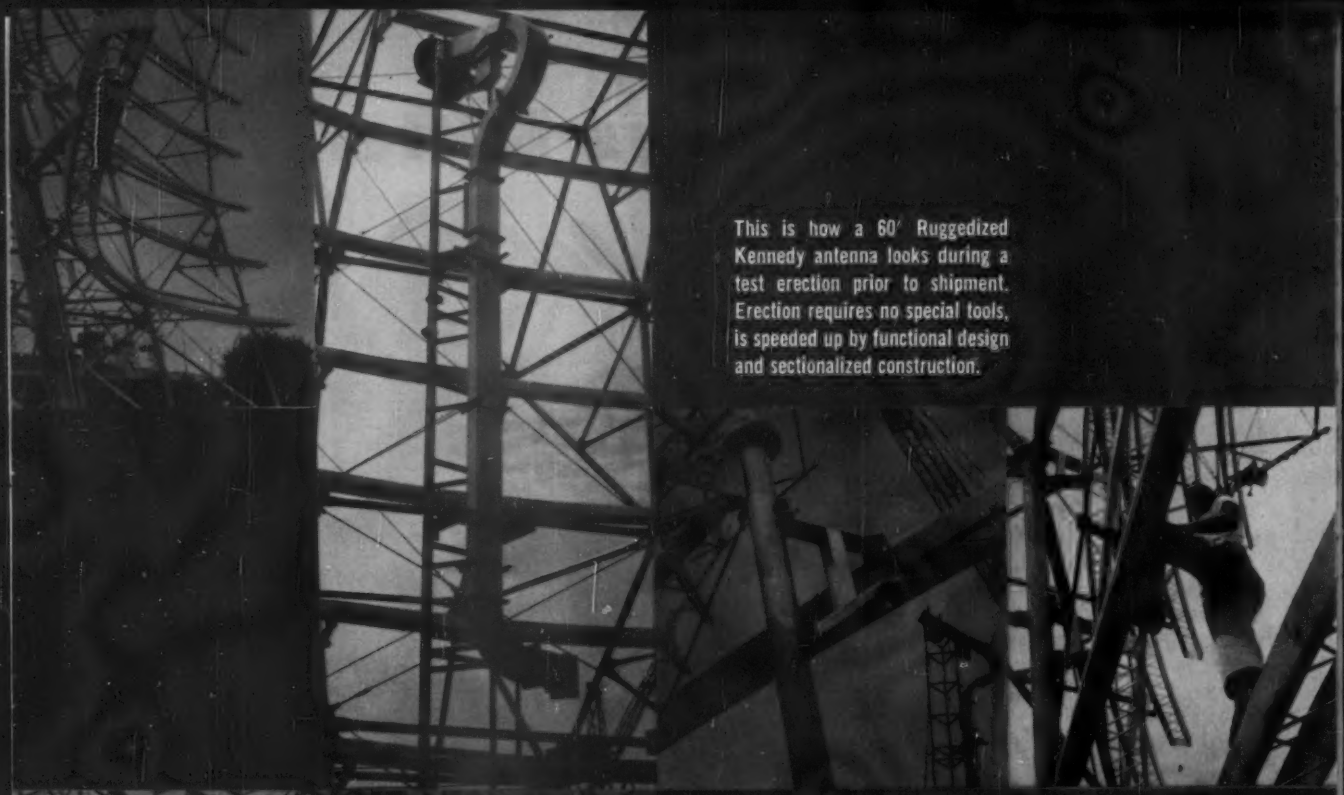
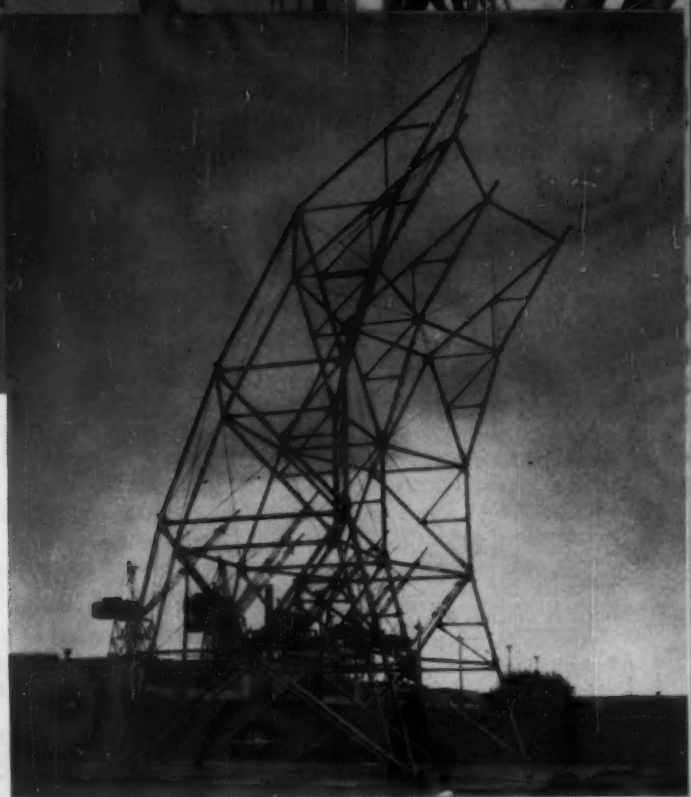


This is how a 60′ Ruggedized Kennedy antenna looks during a test erection prior to shipment. Erection requires no special tools, is speeded up by functional design and sectionalized construction.



ANTENNA...GOING UP!

No matter which way you look at it, this new 60′ Ruggedized Kennedy antenna, slated for service in the northern latitudes, is a real cold-weather performer.

The all-steel reflector is capable of operating when loaded with ice in winds as powerful as a violent hurricane. Yet its simple, functional design and sectionalized construction permit assembly and erection with standard tools at sub-zero temperatures. Its weight is just half that of present steel antennas of comparable size, minimizing shipping problems. Spare parts requirements are simplified, since all like sections are interchangeable. And its galvanized steel construction limits maintenance mainly to routine inspection.

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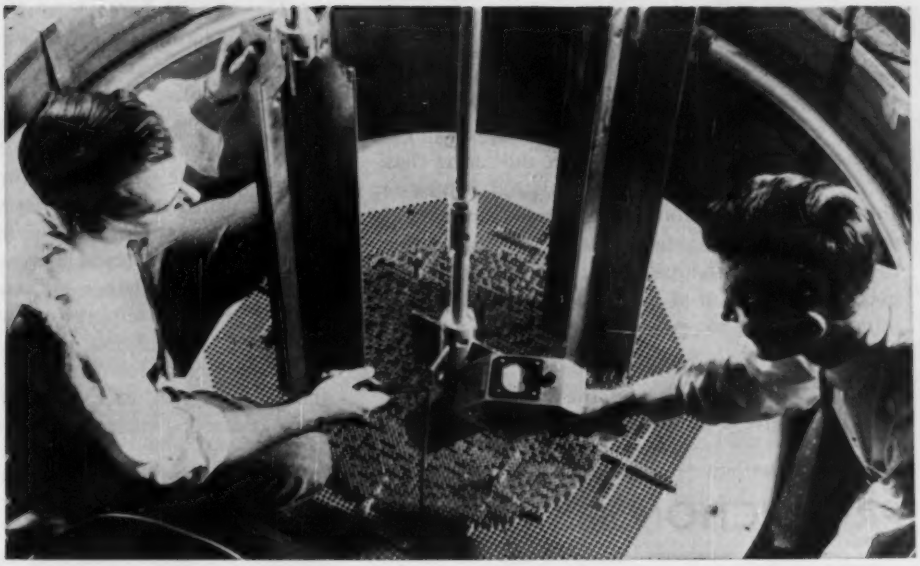
electronics
business issue
NOVEMBER 14, 1958



Checking reactor design for Yankee Atomic Power Plant. Need for electronic control and instrumentation presents opportunity. Here's a close look at one reactor control setup, an indication of . . .

Our Future in Atomics

LAST MONTH the first of two nuclear reactors for the land-based prototype of a naval surface-ship power plant went critical. The prototype power plant is under construction at the Naval Reactors Facility, Idaho Falls, Ida. From this work will come two nuclear-powered naval surface vessels: the guided-missile cruiser *Long Beach* and the aircraft carrier *Enterprise*. Westinghouse developed the prototype power plant in conjunction with the AEC.

The development of nuclear power plants for surface ships adds still another link to the growing chain of nonweapon applications of atomic energy. Right now throughout the world there are nearly 200 atomic reactors. Of these about half a dozen are central station power plants, about a dozen are naval power plants and the remainder are testing and experimental reactors.

Nevertheless, many scientists and engineers agree that nowhere in the world is atomic power economically feasible today. They feel, however, that by 1967 utilities will be able to consider atomic power competitive economically with conventional power, even in the high-fuel-cost areas of the U. S. Atomic plants are today generating 300,000 kw of fission power for central station use. World potential for atomic power is 15 million kilowatts by 1965-1970. Many observers concede that controlled nuclear fission is at least two decades away.

Of course, the electronics industry is interested in atomic power principally as a market for measuring, control and monitoring equipment.

It is difficult to generalize about the electronic complement of a nuclear reactor. A small experimental critical unit may be heavily instrumented; a central station reactor many times larger will probably need only a slightly larger number of instruments and controls.

Electronic instrumentation at the Westinghouse Testing Reactor, shown to the press last month, gives some idea of the kind and amount of electronic equipment it takes to control a reactor. The nuclear unit there will be used for irradiation test-

ing of fuels and materials for reactor use and for limited production of radioisotopes. It is a water-cooled and -moderated thermal-neutron reactor giving about 20,000 kw heat equivalent power output.

Here's what it takes to control this reactor: Primary indication of reactor performance is derived by counting neutrons produced. Three levels of neutron counting are employed. In the source range, used when starting the reactor, integrating neutron counters are used. Two such channels are provided in case one fails. The source-range counters count individual neutrons and give an integrated count indication.

There are two intermediate-range indicating channels. These use gamma-compensated ionization chambers as the neutron-detecting transducers. Such devices deliver a varying current output rather than the count of individual neutrons and are consequently more useful at higher neutron fluxes in the intermediate reactor power range.

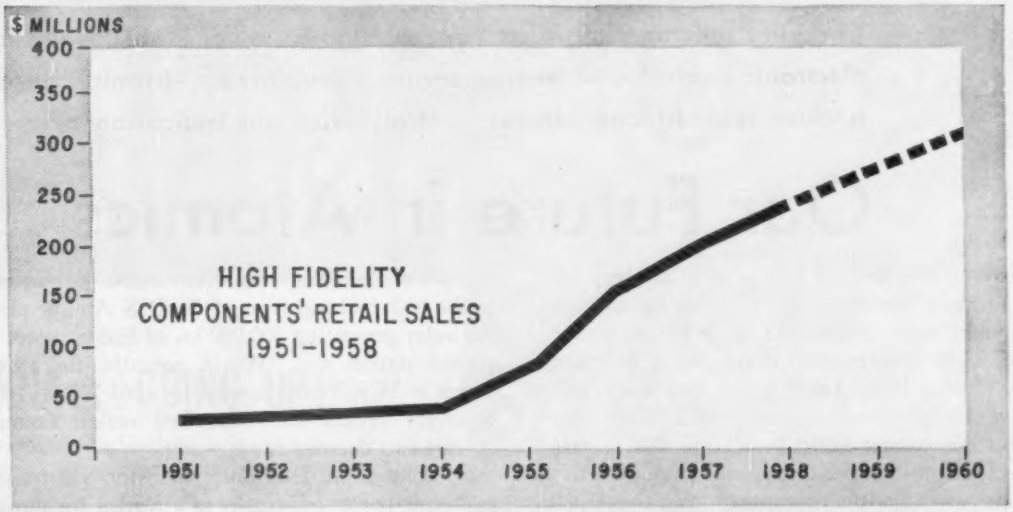
In the power range of reactor operation, fission chambers are used to detect the neutrons. These transducers give a multiplying effect and provide a high current output to indicate neutron flux. This high current indication permits use of magnetic amplifiers in the indicator circuits for added reliability. There are three power level indicator channels with repeater indicators on the operator's panel.

The nine reactor control rods are servo-controlled and tied into the power level indicator channels.

The reactor control panel has a closed-circuit television monitor to observe hot areas. There are five chart recorders: start-up level, power-range level, primary coolant flow, reactor period and thermal power output. Also, two coolant conductivity meters and a pH meter. Electronic circuits likewise are used in the scram and alarm circuits that permit immediate reactor shutdown in case of emergency.

Radiation monitoring equipment will be installed to check stack gas and atmosphere within the reactor vapor container. Thermocouple amplifiers will be used for temperature measurements around the plant. In addition, the testing reactor will have three hot cells for handling radioactive material taken from the reactor. Each cell will use two servo-controlled master-slave manipulators.

PRODUCTION and SALES



Hi-Fi Component Sales Setting Record

RETAIL SALES of high fidelity components are seen on the way to a new high by the end of 1958. A record of about $240 million is in view. 1959 sales may reach $275 to $300 million. 1957 total was about $225 million, according to the Institute of High Fidelity Manufacturers, which expects a slightly higher figure than $240 million for this year. Institute definition includes tape recorders, estimated at well over $100 million volume for 1958.

This record does not include packaged hi-fi instruments, estimated earlier this year at about $400 million by RCA spokesmen. Packaged goods have grown steadily but more slowly than the burgeoning components business, which is only eight years old. Packaged-instrument firms, mostly radio-tv manufacturers, are playing up stereo heavily, as are components people. Stereo confusion of early 1958 is clearing, and sales in both categories are stepping up over normal seasonal peaks.

Percentage of speakers sold in components systems is about a quarter of all units, slightly higher than amplifiers.

Tooling Up Electronically

International and domestic space age competition put pressure on U. S. industry to accelerate use of electronic controls for machine tools and assembly lines

AMERICAN private industry today is fighting its own cold war with the Soviet Union. It's economic riskmanship; it involves tooling up for the space age by spending money to develop and use new electronic controls for machine tools and assembly lines.

In Russia the battle line is drawn firmly by the state economic planners. New seven-year plan pushes many 1972 production goals ahead to 1965, based on the introduction of new automatic controls.

Recent visitors to the USSR were told that 15 different numerically controlled milling machines had been designed, but they were not shown any in operation. Instrumentmakers, whose designs have lagged behind their American counterparts, have been given their orders in recent months.

Here's what the U. S. is doing to increase productivity through electronic automatic controls, according to a survey made by ELECTRONICS:

- Machining speed and accuracy demanded by aircraft and missile industry has already brought about a formidable union of tools and electronics. As a consequence, aircraft firms are now marketing the products of their own requirements.

- Important and old-time machine tool makers are either in electronics themselves, are working closely with an electronics company, or are studying the possibility of doing one or the other or both.

- Some 30 electronics firms reportedly are trying to sell gear to or work with machine builders.

Market for Electronically Controlled Tools

Consensus of machine tool makers in the East is that electronically controlled units will represent about 10 percent of the tool market in 1958-59, with a jump to between 25 and 50 percent in five years. On the West Coast there is general agreement that the national market next year for controls alone will be between $6 and $10 million, and that the sales prospect in five years is $50 million.

Large Midwestern machine tool builder expects a 10-percent increase in the market for electronically controlled tools in the next year, and believes the market will double in five years. Firm says 25 percent of its special tools are already electronically controlled, plus many of its standard machines.

One Eastern firm specializing in numerical controls for airframe fabrication tools sees a drop in business next year, then a buildup. Its explanation: "The aircraft industry has bought large quantities of tools in the last few years. These will have to be assimilated before the next buying round."

Costs and Use of Tool Controls

Although most industry men believe electronic applications to machine tools are unlimited, they indicate present uses are now largely confined to point-to-point or continuous path operation.

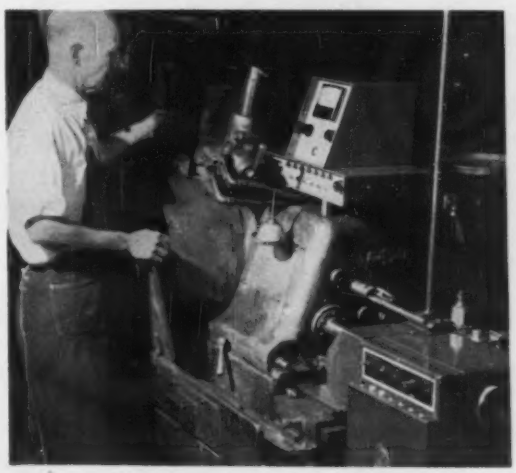
Autonetics division of North American Aviation feels the best acceptance of controls now is in the positioning field because no computer problem is involved, cost considerations don't loom as large.

Many users of electronically controlled machine tools feel cost is still high, but think that general acceptance will be fostered by lower prices in the future through simplified designs.

Tracer or Numerical Control?

Numerical controls market will eventually have the edge over tracer controls due to versatility and wider application possibilities, some sources feel.

A few firms estimate that half of the machine tools produced five years from now will have numerical controls. One, Burg Tool Manufacturing, predicts



Inchworm made by Airborne Instruments Laboratory controls grinding to millionths of an inch tolerance at Torrington Co. needle-bearing plant

that 90 percent of its business in 1963 will be in electronically controlled gear.

On the subject of relative costs, The Cincinnati Milling Machine Co. says this: Tracing is about twice the cost of the conventional step-by-step method, with numerical control at about five times the cost of tracing. Company cites the "considerable time and expense involved in the making of templates for the tracer controlled machines." It adds that the numerical or programming method realizes considerable time saving.

Concord Control, Inc., of Boston, says numerical controls are worthwhile where short run, rapid-change production is involved. "Flexibility is useless in producing hairpins," firm says, "but it is important in machine tools and vital in airframe fabrication."

Programmed production of printed circuits or instruments could benefit from numerical controls, this concern asserts. It says differences in successive units could easily be handled by changing numerical instructions while the gear itself remains the same.

West Coast manufacturers say tracer controls are more economical for some applications, but feel generally that within five years most tracer systems will give way to numerically controlled devices.

One example of a machine tool builder in the numerical control field is Jones & Lamson. For four years this firm worked with electronics companies, now is doing most of its own development work and starting to build its own control gear. J&L reports it has sold a dozen numerically controlled positioning tables, adds that adaptations have been made in standard machines for drilling printed circuit boards and punching electronic chassis and panels.

The New England toolmaker has also sold a half dozen automatic turret lathes with in-machine gaging and statistical feedback. Firm says numerical control gives lathes more versatility and widens applications.

Another New England machine tool maker reports selling 45 to 50 units of electronic controls for boring, milling, drilling and inspection machines.

Production and Assembly Controls

Important factors in determining whether to use automatic controls for assembly lines: cost, repetition of movement and absence of need for human decisions along the line.

In the West an aircraft manufacturer reports spending considerable money on R&D for automation devices and assembly line controls. While the firm does not expect an impressive increase in next year's market, it's "quite certain" that acceptance of such controls will pick up in the next five years.

Spokesman for Stromberg-Carlson's Electronic Control Systems division believes acceptance by many manufacturers of electronic control gear will come in the "near future." Examples: gear to perform staking operations, component insertion and similar operations.

Market for Assembly Controls

Most firms questioned about the market for electronic assembly controls declined to answer on grounds that the field is too new and wide open. One firm points out that the electronics industry itself is moving into the use of controls in the manufacture of printed circuitry and components, but doesn't expect spectacular results in the next year.

But in five years, says this firm, military pressure for use of such assembly controls could mean a $25-million market. Another firm sees the possibility of a $5-million market by next year and a $50-million market in five years.

There's a long way to go before many assembly lines are automatic, in the view of one West Coast firm. It sees controls as applicable to component lines, ball bearings and other standardized products, and possibly to some subassembly of mass produced products that might need feedback control.

Topp Industries reports it's planning to expand its production of automatic assembly line controls, is now preparing servo packages of electronic positioning controls suitable for continuous variable positioning of such parts as transfers and valves.

Plans for use of digital and/or analog computers in assembly line control systems vary from company to company. One firm uses digital controls but also combines analog and digital methods to reduce costs. It says its systems are 100 percent programmed, do their job with the press of a starter button by an operator, who puts in a new work batch when program is completed. Some control systems using taped instructions do not require a computer.

New computer directed process control system was recently announced by Librascope, Inc., a subsidiary of General Precision Equipment Corp. Firm says its Libratrol-500 is designed to accommodate new sensing and control devices as they are developed; it's also said to permit a transition from manual to completely automatic process control.

Librascope says the system accepts both voltage and digital signals from a variety of instruments. Input selection and control circuit segregates incoming information and routes it to an arithmetic unit, a decision and verification unit and to the memory drum. Built-in digital clock provides real time factor, and an output selection and control unit chooses control or data presentation channels.

Computer uses binary code; conversion unit performs translation of analog signals. Output may be in the form of typewritten data, monitor display, alarm lights or bells, or as correcting signals—electrical, pneumatic, mechanical or hydraulic—to operate controllers within the processing gear.

COMING

IN

1959

COMING IN 1959

SPECIAL ISSUES FOR 1959

Electronics in Space

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Dimensions	
Type A	2"x.9" square
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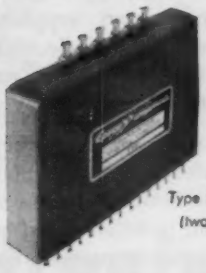
Transistor Logic	1.5 μsec max
Signal Voltage Levels	0 and −6 volts
DC Supply Voltages	±18 volts, ±6 volts
Temperature Range	−55°C to +75°C



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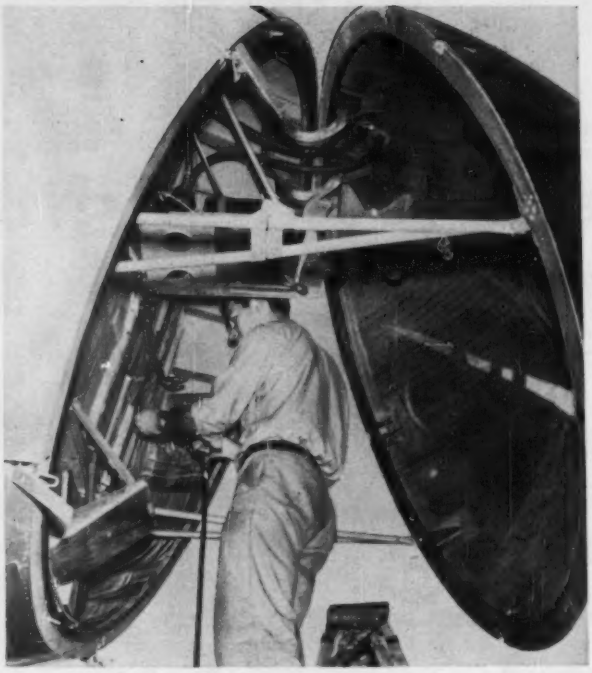


Outfitting New Jet Airliners

LOS ANGELES—A FEW DAYS AGO some 15,000 engineers, technicians and scientists wandered through the Aircraft Electrical Society's 15th Annual Display in the Pan Pacific Auditorium here. Had this been 50 years ago, they would have seen four items exhibited: a magneto, a sparkplug, a piece of wire, an ignition switch. As it was, they saw wares of 145 companies, valued at several million dollars, in 200 exhibits. Better than half were electronic in nature.

Electronics for the airlines is big business, getting bigger. First U. S. jetliner entered passenger service in October. Orders for $2.5 billion worth of turbojets and turboprops have gone to the nation's five major airliner producers. Some $981,000,000 of this will go to 5,000 subcontractors, suppliers, vendors, of whom a large number are in electronics. One estimate places the initial electronics requirements of these 600 planes at $80 million.

Ten years ago the average airliner carried about $12,000 worth of electronic gear. Tab for electronics on today's up-to-the-minute prop-driven craft is close to $98,000 (including installation and spares). Factors in this difference: omnirange navigation (VOR), air traffic control transponder (radar beacon), radio altimeter, weather radar, distance measuring equipment (DME).

Frequently today's liners have dual installations, such as two VOR receivers, two glide slope indicators, in case one fails, or to check one instrument against the other.

Another reason for increased cost of plane's electronics: today's autopilots, and even h-f antenna tuners, are tailored to each plane, thus cost more than off-the-shelf items. Some producers are even adding such electronic improvements as Douglas' hi-fi public-address system (DC-8) for high intelligibility and music in flight.

Electronic equipment for tomorrow's jet liner will cost about $150,000. Flight recorders and Doppler navigation computers will cost about $5,000 and $10,000 respectively. New installations are sure to include proximity warning indicators (PWI) or collision avoidance systems (CAS) when available.

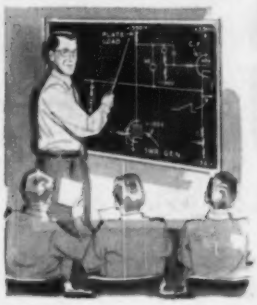
Airways Modernization Board is pushing for revamping of airborne navigation, communications, and data processing equipment to improve air traffic control. One major jetliner producer predicts that five years hence the electronics bill per plane may come to $250,000.

Ground personnel and air crew will communicate with each other via automatic interrogating-transponding systems for altitude, course, air velocity, weather. Cut-downs on voice time are expected to relieve congestion on over-crowded frequencies.

As in the case of weather radar, electronic gear producers hope to push other equipment through pilot enthusiasm. Convinced of radar's usefulness, pilots demanded it for their planes. Now two-thirds of the nation's airline fleets are equipped. If new systems, such as Doppler, enjoy similar reception there will be a big retrofit business. For example, there are more than 1,000 planes of the DC-6 and 7 series in operation, and at $30,000 per dual installation, these alone would provide a sizable market.

The Manufacturer's Responsibility to the User

YOUR REQUIREMENTS for increasingly higher performance in oscilloscopes inevitably lead to instruments of greater complexity, and therefore to an enlarged responsibility on the part of the instrument manufacturer to provide needed assistance in the field. As a user of Tektronix Instruments you have easy access to a large well-trained field organization, anxious to help with any problems that arise due to unfamiliarity with new circuits or other factors. All services described below are readily available through twenty-four Tektronix Field Offices in North America. Most of these services are also provided by more than twenty Tektronix Engineering Representatives in pertinent overseas locations.



Maintenance—Tektronix willingly assumes much of the responsibility for continued efficient operation of the instruments it manufactures. If you should experience a stubborn maintenance problem, your Field Engineer will gladly help you isolate the cause. Often a telephone discussion with him will help you get your instrument back into operation with minimum delay. If yours is a large laboratory, your Field Engineer can be of service to your maintenance engineers by conducting informal classes on test and calibration procedures, trouble-shooting techniques, and general maintenance.

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Applications—Perhaps the answers you need in a specific application can be obtained faster and easier through use of your Tektronix Oscilloscope. Your Field Engineer can help you find out, and if use of your oscilloscope is indicated, help you with procedures. He may also be able to suggest many time-saving uses for your oscilloscope in routine checks and measurements.

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If you are a Purchasing Agent or Buyer, your Field Engineer or his secretary can help you with information on prices, terms, shipping estimates, and best method of transportation on instruments, accessories, and replacement parts.

Operation—Your Tektronix Oscilloscope can be most useful to you when you are familiar with all control functions. Your Field Engineer will be glad to demonstrate the use of your instrument in various applications to help you become more familiar with its operation. If your instrument is to be used by several engineers, your Field Engineer will be happy to conduct informal classes on its operation in your laboratory.

Communications—Your Field Engineer is a valuable communication link between you and the factory. He knows the exact person to contact in each circumstance, and he can reach that person fast and easily. Let him help speed your communications with the factory on any problem related to your Tektronix Instruments.

Instrument Reconditioning—An older Tektronix Oscilloscope, properly reconditioned, can give you many additional years of service. Your Field Engineer will gladly explain the advantages and limitations of factory reconditioning, and make the necessary arrangements if you decide in favor of it.

Many major repair and recalibration jobs can be performed at a nearby Field Repair Station. Ask your Field Engineer about this at-cost service to Tektronix customers.

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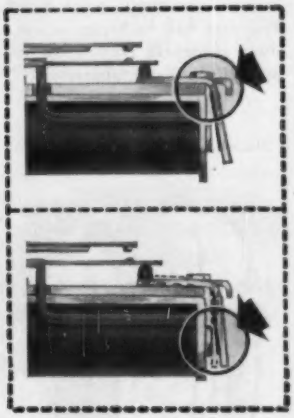

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New England Eyes R&D Payoff

Big show next week sparks push for sales upswing. Northeast area firms see '59 and '60 as key growth years. Engineering-in-depth, strong position in military electronics buoy optimism

BOSTON—FORTIFIED IN DEPTH by heavy R&D investment New England electronics industry stages its big show here next week in a "payoff" atmosphere.

"Today's Electronic Developments—Tools for Tomorrow" is theme of NEREM (Northeast Electronics Research and Engineering Meeting) on Wednesday and Thursday at Mechanics Building.

A bigger slice of production volume is '59 target for many of the area's research-based companies. Item: One firm specializing in data control, with high engineering cost ratios for several years, will do $4-5 million in '58 sales, already sees this doubling in '59 with bread-and-butter contracts now in the works. Area firms in general look to '59 and '60 as growth years, especially in view of New England's strong position in military electronics.

With more than 200 exhibits, and attendance expected to total between 5,000 and 6,000, NEREM claims fourth place among national electronics shows, although it was graduated only a year ago from regional status.

NEREM sponsors—Boston, Connecticut and Western Mass. sections of IRE—shun door prizes, etc., in nourishing show's growth. "Promoting registration and improving the program are our only gimmicks," comments NEREM official.

Nearly one-half of booths have been booked by "outside" manufacturers. Policy limits reps to two booths each. Many reps have talked some of their manufacturers into taking individual displays.

NEREM's 44 technical papers stress research and design engineering, in keeping with New England's R&D strength. Although sponsors planned to go outside to a greater degree this year for papers, quick response from area scientists and engineers resulted in the bulk of the program representing the Northeast. Carrying out R&D payoff atmosphere, an evening session will be held on inventions and patents—three papers on the inventor's viewpoint and on commercial and legal aspects.

New England electronics industry boasts more than 600 firms, plus what a top industry executive recently called "the most impressive concentration anywhere of advanced technological educational facilities and talents." Nucleus includes MIT, Harvard and Hanscom Field, home of AF Cambridge Research Center and Lincoln Laboratory.

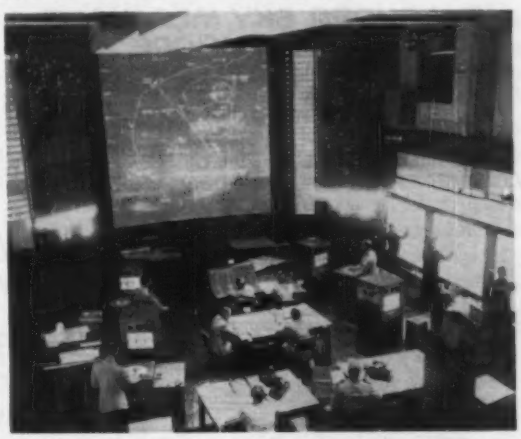
Stemming from this concentration is the astonishing development of Massachusetts Route 128, "Electronics Highway."

An electronics firm on Route 128 recently went into the equity market, offering common shares at 16. Within hours after sale opened, stock zoomed to 26, and financial observers attributed it in part to "the glamour of Route 128." With electronics as the core, new industrial communities have mushroomed along the highway rimming Boston.

Industry estimates on New England's share of national gross factory sales of electronic products this year range from 13 to 16 percent. It is generally agreed the area will produce $1.1 billion—out of a national volume estimated at $8.4 billion.

Growth in next decade is expected to make electronics New England's largest industrial activity. In Massachusetts, it's now close behind shoe-leather and textiles, with more than 65,000 Bay Staters earning their livelihood in this key growth segment of the industrial picture. Massachusetts takes fourth place in gross factory sales of electronic products—after New York, California and New Jersey.

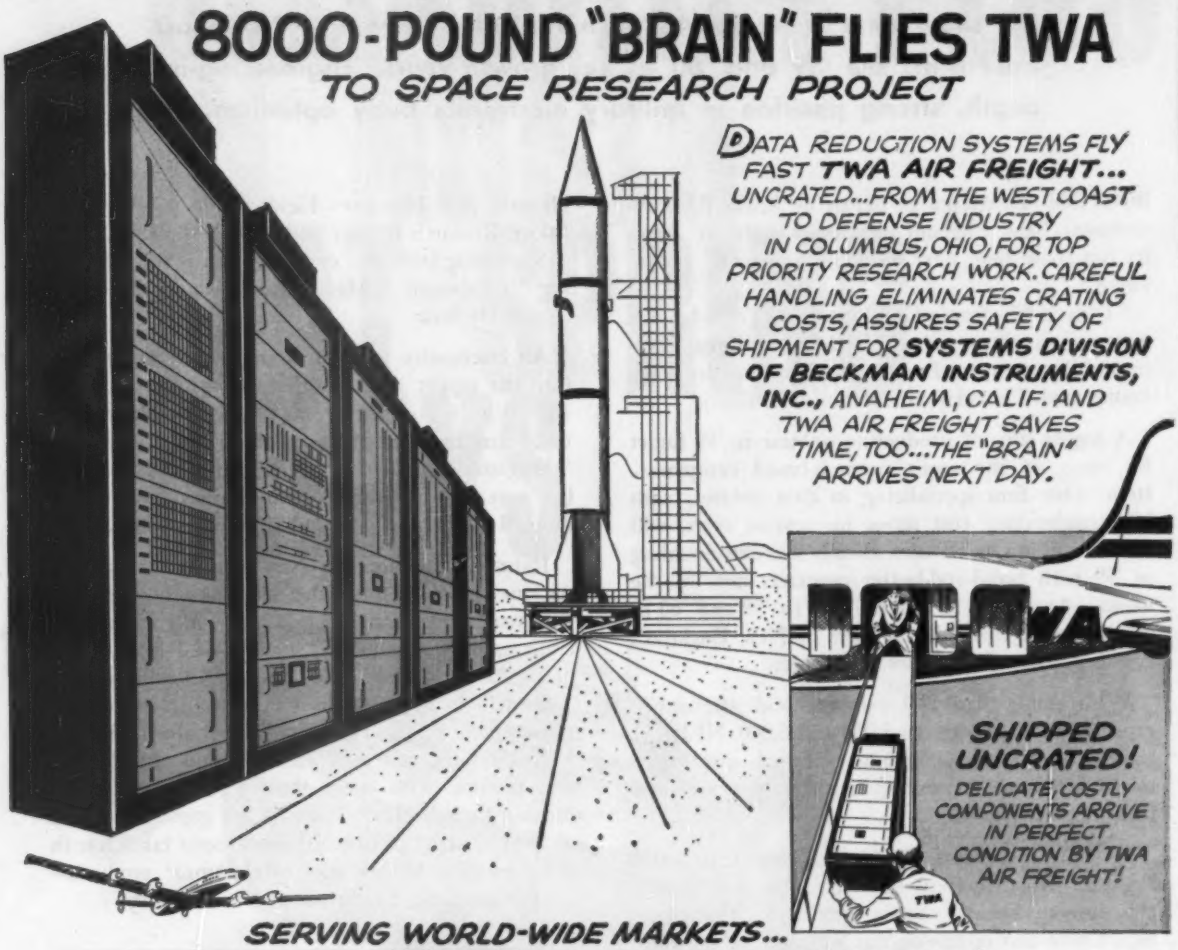
Electronic Warfare



Only umpires see the "big picture" as opposing forces move to engage each other on Navy's new $7-million electronic warfare simulator. **(See story p 30)**

ALONG THE WAY . . . OF TWA

8000-POUND "BRAIN" FLIES TWA
TO SPACE RESEARCH PROJECT



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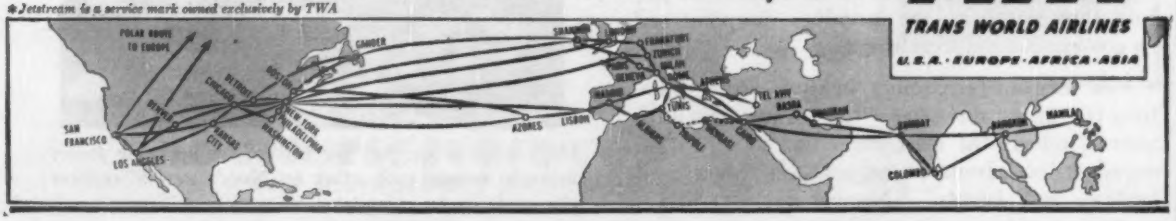


ENGINEERING REPORT

Sees Boom in Diffused Silicon Transistors

DIFFUSED SILICON transistors will account for 70 percent of all transistors manufactured by 1963. That's the prediction given recently at the 1958 Electron Devices Meeting of the IRE by J. J. Ebers of Bell Telephone Labs. Ebers estimated that the remaining output would be mostly alloyed germanium units and some of diffused germanium. He predicted that by 1968 diffused germanium would exceed alloyed germanium units. Ebers said 75 percent of all semiconductor diodes by 1963 also would be diffused silicon units. He declared a "plateau" had been reached in transistor technology, with emphasis now on refinements in the manufacturing process rather than in the introduction of new transistor types.

JAPANESE RADIOS made a big dent in the U.S. market for portables in the first half of 1958, rising to 30.40 percent of the market from 16.43 percent for all of 1957. Figures just obtained from the Electronic Industries Association disclose that the market percentage for Japanese sets was 19.51 in the first quarter, 39.70 in the second quarter. Second quarter breakdown shows: Japanese sets accounted for 39.82 percent of the market for transistor radios and 39.37 percent of the market for non-transistorized sets.

• **Japanese Trade Ministry** figures indicate that more radios were exported to the U. S. in the first half of this year than in all of 1957. Last year the U. S. imported 102,240 transistorized units and 539,760 units with tubes, a 642,000 total. In the first half of this year 475,417 transistorized and 194,583 non-transistorized sets were imported for a 670,000 total.

PRODUCTION OF U.S. PORTABLE RADIOS amounted to 3,265,328 last year, including 1,610,916 transistorized and 1,654,412 non-transistorized sets, according to EIA. Total for the first half of '58 is 1,533,946, of which 1,076,413 are transistorized and 457,533 non-transistorized portables.

• **EIA reports** that the U. S. market for transistorized radios in the first half of 1958 amounted to 1,551,830 units; total 1957 market was 1,713,156 units. Market for non-transistorized portables totaled 652,116 in the first six months; year's total in '57 was 2,194,172.

TRAVELING WAVE TUBES may account for $7 million worth of production orders for the electronics industry in 1959. That's the estimate Hans Jenny, Manager, Microwave Engineering, RCA Electron Tube Division, gave the IRE 1958 Electron Devices Meeting. This year, he said, twt's "were placed on a full production basis for the first time" and were accepted as "a reliable-systems component." In recent years, laboratory facilities have been turning out twt's for countermeasures and other military uses.

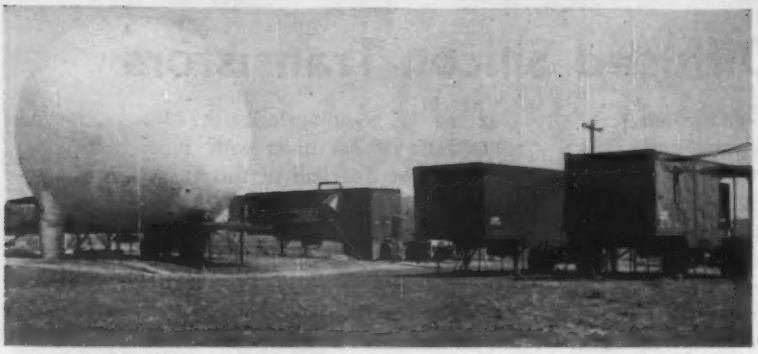
TECHNICAL DIGEST

• **Automatic** bandwidth control for f-m tropospheric scatter receiver gives up to 10 db improvement in reliability or corresponding increase in channel capacity, reduction in power needs or reduction in antenna size. Circuit used by Collins derives d-c voltage from r-f carrier signal to change bias of cathode follower amplifiers, thereby varying the Q of several resonant circuits in i-f amplifiers so as to reduce bandwidth when received signal approaches threshold level.

• **Effect of freezing** and thawing cycles or heat shock on clay products can be determined nondestructively by vibrating sample at its resonance frequency and measuring dynamic modulus of elasticity. Lengthwise vibration is induced by transducer fed by variable audio generator. Transducer at other end of sample feeds maximum signal to scope at resonance, from which the modulus can easily be determined. Technique is used in France.

• **Ion-microscope** developed in Germany shows promise in studying interactions of ions and matter. Object is supported on silver-coated carbon film that serves as cathode of electrostatic objective lens. After passing through specimen, ion beam is absorbed in silver film, causing emission of electrons that are used to form image of object. Resolving power is still inferior to that of best electron microscopes, though theoretically it should be better because wavelength of ion beam is much shorter.

• **Frequency-sidestepping** reduces binary signaling errors in radio circuits affected by multipath propagation. In Rixon Electronics technique, both receiver and transmitter are synchronously shifted to new carrier frequency after reception of signal over shortest path, so inherent selectivity of receiver blocks undesired signals arriving over longer paths. Number of frequency shifts needed before returning to original frequency is determined by time difference between longest and shortest paths and by signaling element duration.



Plastic balloon houses antenna of new radar system that detects target altitude without mechanical motion

Electronic Scan Ups Radar Range

GREATER RANGE is claimed for an electronic-scanning radar recently revealed by Hughes Aircraft. It is called the Frescanar. Scanning in the vertical direction is accomplished by varying frequency of the applied electromagnetic energy.

The radar is still rotated in azimuth mechanically, but a spokesman for Hughes says the principle now applied to altitude search can be applied to azimuth search. Reports are that the firm will complete development in this direction by next year.

Improved range performance is said to result from concentrating energy in a pencil-shaped beam. Many ground radars transmit fan-shaped beams from one antenna to get azimuth data.

Information on range of the new system is being withheld, although Hughes reports "from 20 to 50 percent" greater range.

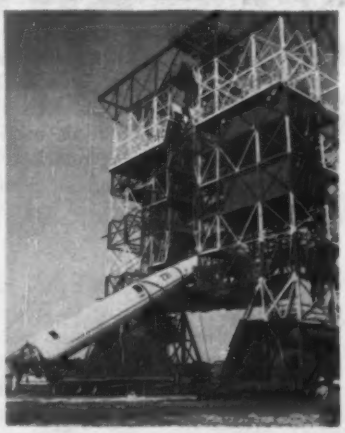
A separate installation is often used with conventional systems for getting altitude information. These systems require more equipment and operators. Further reduction in system size and weight of the Frescanar is achieved by using transistors.

An Army contract has been awarded to Hughes for construction of three of the new radars. They will go in the Army's missile monitor system, which is the field counterpart of the missile master system designed to control the Nike-Ajax, Nike-Hercules batteries protecting U. S. cities.

In operation, the radar detects targets in range, bearing and altitude. The information is fed electronically to the radar processing center. This unit converts visual target data into digital form, sends it to a weapons monitoring center, battalion operations centers and weapons battery terminal equipment—all part of the missile monitor system.

The group commander at weapons monitoring center has complete information on aircraft in his area. He can select and assign targets to appropriate missile batteries. The battalion commander operating the battalion operations center feeds information to the weapons complex to coordinate and distribute fire power.

Moon Probe Carries Electronics Package



Lunar probe combines three rockets to get 83.8-lb terminal package in vicinity of moon. Electronic instruments include magnetometers, micrometeorite impingement transducers, temperature sensors, photoelectric camera

MEETINGS AHEAD

Nov. 17-20: Magnetism and Magnetic Materials, AIEE, APS, IRE, ONR, Sheraton Hotel, Philadelphia.

Nov. 17-20: Weather Radar Conf., Univ. of Miami, Miami Beach, Fla.

Nov. 17-21: Space Flight Engineering Conf. and Exposition, American Rocket Society, Statler-Hilton Hotel, New York City.

Nov. 19-20: Northeast Electronics Research and Eng. Meeting, NEREM, IRE, Mechanics Hall, Boston.

Nov. 19-21: Electrical Techniques in Medicine and Biology, AIEE, ISA, PGME of IRE, Nicollet Hotel, Minneapolis.

Dec. 2-4: Reliable Electrical Connecnections, EIA, Statler-Hilton Hotel, Dallas.

Dec. 3-5: Global Communications, AIEE, PGCS of IRE, Colonial Inn-Desert Ranch, St. Petersburg, Fla.

Dec. 3-5: Eastern Joint Computer Conf., AIEE, ACM, IRE, Bellevue-Stratford Hotel, Philadelphia.

Dec. 4-5: Vehicular Communications, Annual Meeting, PGVC of IRE, Hotel Sherman, Chicago.

Dec. 9-11: Mid-America Electronics Convention, MAECON, Municipal Auditorium, Kansas City, Mo.

Jan. 12-14: Reliability and Quality Control, 5th Nat. Symp., PGRQC of IRE, ASQC, EIA, Bellevue-Stratford Hotel, Phila.

Jan. 21-23: Southwest Electronic Exhibit, Arizona State Fairgrounds, Phoenix, Ariz.

Jan. 29-30: Long-Distance Transmission by Waveguides, Institution of Electrical Engineers, London, England.

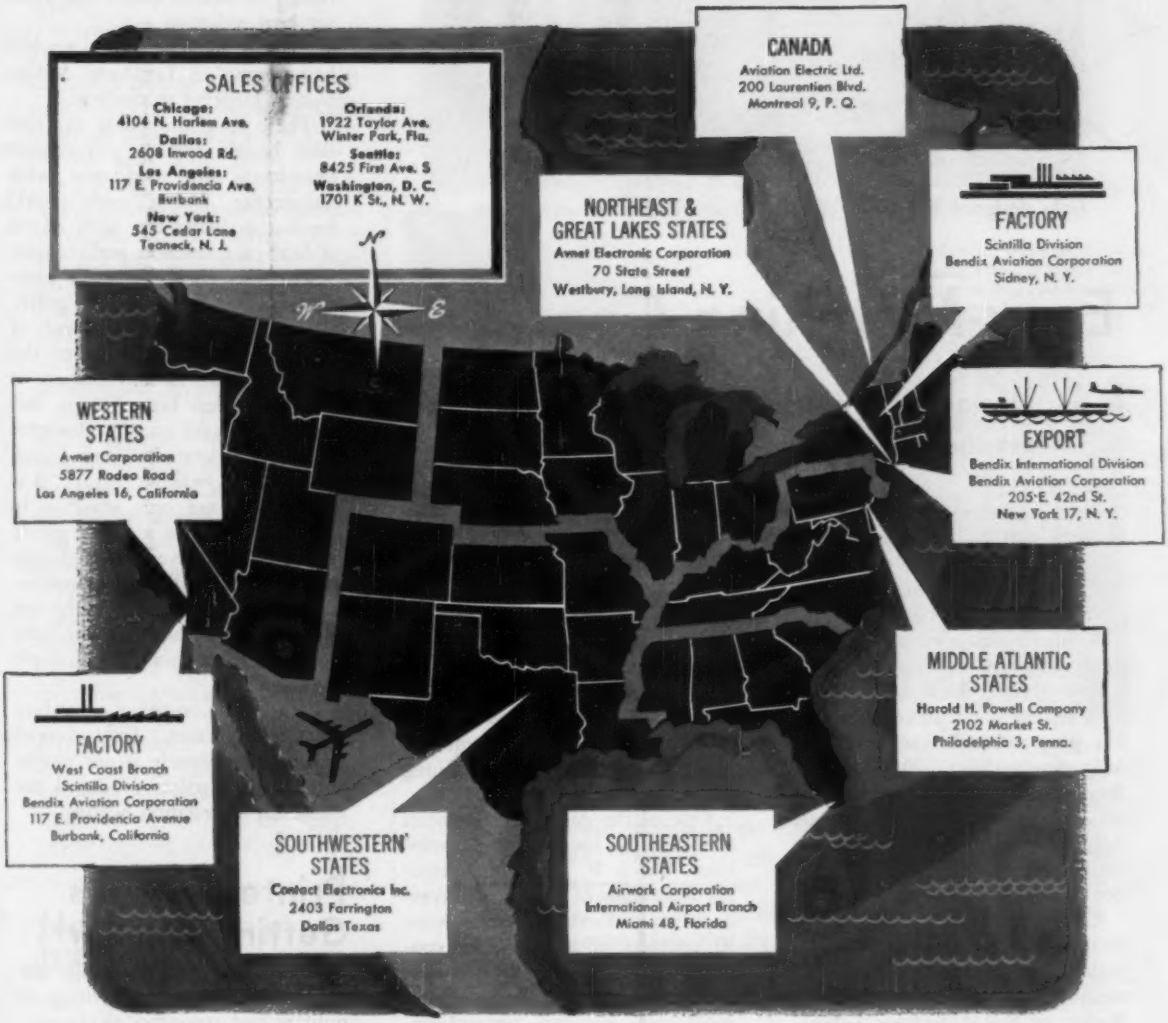
Feb. 12-13: Transistor & Solid-State Circuit Conf., AIEE, PGCT of IRE, Univ. of Penn., Phila.

Mar. 3-5: Western Joint Computer Conf., AIEE, ACM, IRE, Fairmont Hotel, San Francisco.

Mar. 23-26: Institute of Radio Engineers, IRE National Convention, Coliseum & Waldorf-Astoria Hotel, New York City.

Mar. 31-Apr. 2: Millimeter Waves Symposium, Polytechnic Inst. of Brooklyn, USAF, ONR, IRE, U.S.A. Signal Research, Engineering Societies Bldg., N.Y.C.

NEW DISTRIBUTION NETWORK MAKES IMMEDIATELY AVAILABLE ALL THE IMPORTANT ADVANTAGES OF BENDIX CONNECTORS



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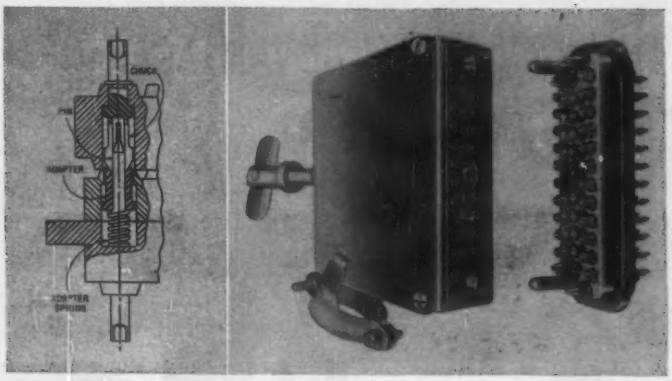


Jacks designed like collet chucks provide 40-pin connector with . . .

Easy-Matching Contact

Damage from brute force insertion is avoided when chucks are screwed onto multicontact pins

UNUSUAL DESIGN for multipin connectors will be discussed at the Third EIA Conference on Reliable Electrical Connections in Dallas, December 2-4. The connector uses the collet chuck principle to obtain high contact pressure with low engaging and disengaging forces.

A typical 30-circuit connector, of the plug and jack type, will probably require 50 to 60 pounds of force for engagement or disengagement. When these forces are applied manually, they can cause breakage or misalignment of the connector or associated apparatus.

Connector breakage is reported to run as high as 50 percent during system development testing, according to D. G. Blattner and R. H. Ricker, of Bell Telephone Laboratories. A further trouble source is disengaging connectors by pulling on the wires.

The connector developed at Bell Labs is intended to correct these problems. Mathematical analysis of the design indicates that 2.5 million connector insertions could be made without failure, in a 40-pin connector. This is equivalent to 500 insertion-withdrawal cycles in system using 5,000 connections.

In actual tests, 200,000 chuck to pin continuity tests were made without failure. The connectors also passed the performance requirements of MIL-C-5015.

As shown in the diagram, four-jawed chucks are tightened onto the pins by springs. The springs are linked to a wing nut which serves all the chuck-pin pairs in the connector. Contact pressure between chucks and pins is about 4,000 psi. Tightening torque is about nine pounds and loosening torque is about 6.5 pounds.

One of the Air Force engineers scheduled to speak at the conference, Galen B. Eley, of Wright Air Development Center, will comment on methods of joining wires to contacts of multicontact connectors.

Eley says the Air Force prefers mechanical pressure connections, such as crimping, to solder. New specs require this type of contact. Where welded connections are made, he suggests pressure forming a terminal barrel over the joint to avoid a high-resistance contact.

A long-standing problem, he says, is the exclusion of moisture from connectors subjected to altitude breathing in aircraft. WADC favors a test in which electrical tests are conducted while the connector is immersed in water and air pressure is cycled. R-type connectors have passed this test.

Barium Titanate Measures Heat

BARIUM TITANATE ceramic, generally used in piezoelectric transducers, is also pyroelectric and could readily be used to detect and measure heat radiation.

That is the conclusion reached by a group of Lockheed Missile System Division researchers.

These men also point out that since barium titanate piezoelectric transducers are used over wide temperature ranges, users should familiarize themselves with effects of heat on transducer performance.

The researchers found the pyroelectric effect primary. The polarization change is independent of the effects of thermal strain on the material. That barium titanate is pyroelectric has been known, but no prior reports on the character of the pyroelectricity were found.

The polycrystalline ceramic, it is reported, is not only sensitive to heat, but also has a fast response time. The effective rate of change of temperature follows the formula: net absorbed power divided by the value of specific heat times density times electrode area times sample thickness.

Light pulses on the disk produce pyroelectric pulses. Tests showed that barium titanate is not photovoltaic. The pulses produced are the result of radiation heating.

Printed Circuits Getting Smaller

THERE WILL BE continually increasing use of printed wiring in military and consumer electronics, home appliances, vehicles and toys. These were market expectations generally voiced at the Institute of Printed Circuits' symposium, "An Analysis of the Next Five Years for Printed Circuitry", in Chicago last month.

Speakers seemed less satisfied with basic materials. There were calls for improvements in dimensional stability and less brittleness to solve production problems, as well as for more consistent electrical properties and lower cost.

While discussing present tech-

niques, some speakers ventured predictions on the future shape of printed circuits:

• Thomas Schlaback, of Bell Labs, saw circuits getting smaller and smaller until active circuit elements are grown in a single crystal.

• Edward Lorenz, IBM, feels miniature equipment will turn to lines and spacing as fine as 0.002 to 0.010 inch, with widths of 0.010 to 0.018 inch coming in on a production basis in five years.

• J. J. Staller, of American Bosch Arma, pointed out that component miniaturization is making circuit line and pad dimensions the limiting factor in efficient use of board area. The result will be smaller line widths, closer tolerances, two-sided circuitry and a limitation on standardized layouts.

Among the potential design trends reviewed by Staller were: welding of components into sticks, construction of circuits and components on ceramic or glass wafers, and the vacuum deposition of circuits as molecular coatings.

James Shickel, of GE, foresees a "gold mine" for printed wiring in home appliances once that industry is convinced printed wiring can carry the loads required: 20 amps continually and 50 amps during surges of about 15 seconds. In five years, Shickel said, there will be adhesives and economical base materials which will take the temperatures required to fry eggs.

New Plastic in Pilot Production

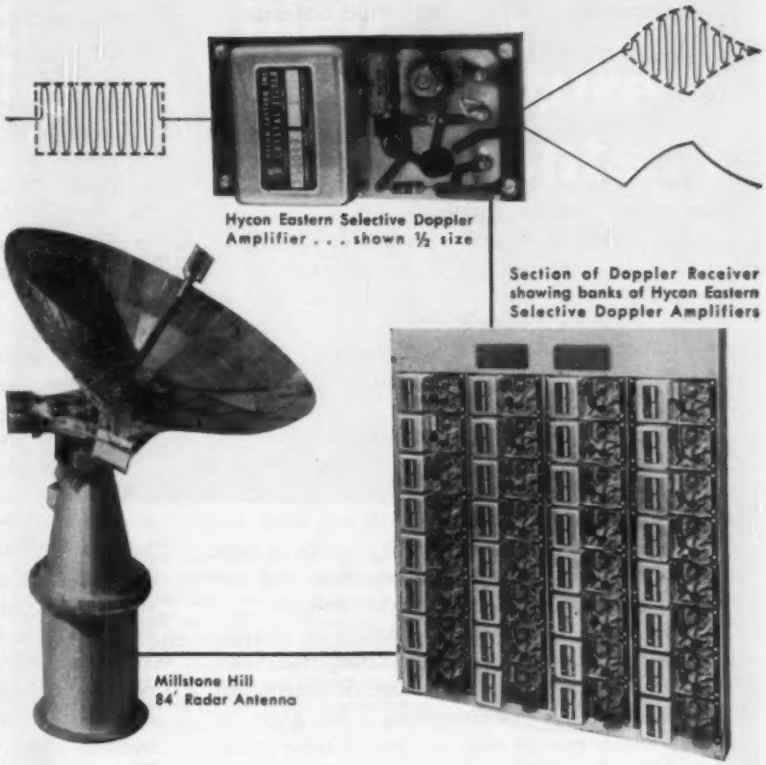
NEW THERMOPLASTIC, polycarbonate resin, is in commercial production with startup of a semi-works plant at GE's Chemical and Metallurgical division. Presently made as a molding compound for components such as terminal blocks, connector housings and coil forms, Lexan can also be dissolved for solution coating and cementing.

Impact strength is 12-16 ft. lbs./in.; tensile strength, 9,000-10,500 psi; flexural strength, 11,000-13,000 psi; continuous heat resistance, 250-275 F and dielectric constant, 3.17. It is transparent, colorable and glossy.

FIRST 1,040 Mile

Pulse Doppler Radar uses

HYCON EASTERN CRYSTAL FILTERS



Hycon Eastern Selective Doppler Amplifier . . . shown ½ size

Section of Doppler Receiver showing banks of Hycon Eastern Selective Doppler Amplifiers

Millstone Hill 84' Radar Antenna

The problems in long range radar for today's ballistic missile defense systems require solutions that are unique yet reliable. Meeting these criteria is the Lincoln Laboratory's "Millstone Hill System". Working closely with Lincoln Laboratory on the transient response problems, Hycon Eastern provided "comb set" crystal filters and associated circuitry forming complete networks termed Selective Doppler Amplifiers.

Hycon Eastern offers a unique customer service by assuming total responsibility for exact pulse output. All crystal filters are tested and aligned under simulated operating conditions, using a pulsed input. Transistor amplification, active impedance transformation, and detector circuitry are provided for complete compatibility with the total system. These integrated units are delivered ready for immediate use.

Hycon Eastern is presently supplying crystal filter banks for airborne intercept, bomber defense, shipborne and land based detection and tracking systems. Write for Crystal Filter Bulletin.

HYCON EASTERN, INC.

75 Cambridge Parkway Dept. A Cambridge 42, Mass.

Navy Unveils War Simulator

Multimillion-dollar complex of computers and communications helps train future commanders

NAVY LAST WEEK lifted the wraps from its Naval Electronic Warfare Simulator (NEWS), pet dream of naval planners since 1945, and in development for the last three years. The NEWS, a $7-million complex of communications, controls and computers, is designed to make possible two-sided war games under extremely realistic tactical conditions.

The system fills a wing of big, old Sims Hall at the Naval War College, Newport, R.I. It was designed by the Navy Electronics Laboratory at Point Loma, Calif., and built by that lab and a handful of West Coast contractors.

NEWS can bring together two opposing sides of 24 "forces" each. Forces can be anything from a single aircraft or destroyer to a carrier task force. These forces engage each other in real time (or even twice or four times real time), strike at each other as directed by student commanders, and sustain damage which is computed electronically.

Even the essentially random nature of damage has been taken into consideration. Both the probability of hit and the extent of damage are determined by generated noise. In computing a hit, a gate is opened which may or may not pass a noise pulse; in resolving the extent of damage, noise pulses passing through an opened gate are counted.

Other component subsystems of the NEWS are parameter storage, built by Librascope, which stores factors in the strike equation for any of Navy's 20 weapon types against any possible target; control-function computer built by Berkeley, which produces the voltages, proportional to hit probability and extent of damage, which in turn govern the hit and damage resolvers; and acquisition switch matrix, built by Packard-Bell, which connects the correct force and weapon to its selected target.

Control-function computer and hit and damage resolvers are time-shared. Necessary parameters switched out of the storage unit by the acquisition matrix are fed to a rotating switch which samples every one of the 192 possibilities once a second.

The 48 forces are governed from 20 command centers. The command centers closely resemble actual shipboard flag plots, control from one to four forces. Each force can be armed with four weapons or weapon groups that constitute its striking power. Commanders get radar or sonar data and identifying information about targets in accordance with preset realistic conditions.

Position of each force at any moment during play is computed by one of 48 navigation computers, built by DuMont Airplane & Marine Instrument. These computers are preset in advance of the game so that a commander cannot maneuver his force except within its actual limitations.

When a commander acquires a specific target, his position and target position, plus the characteristics of the weapon with which he chooses to strike, become inputs to the control-function computer. This gates the two resolvers, which produce hit data and reduce the effectiveness of the target.

Umpires watch whole play in a darkened amphitheatre next to master control room. Action is optically projected on a wall-size screen by 48 lamps slaved to the nav computers (see photo p 23).

MILITARY ELECTRONICS

• **Bomarc** intercept missile testing facilities will be moved from Cape Canaveral, Fla., to the Air Proving Ground Center missile site on Santa Rosa Island near Fort Walton, Fla. The move is expected to be completed by late 1959. The site will also be used for training missile crews. Communications and radar tracking equipment for Bomarc is sold directly to Hq., Air Materiel Command, Rome AF Depot, Griffiss AFB, Rome, N. Y. Electronic ground equipment for USAF missile sites bought by Rome amounts to approximately $100 million a year. With more missiles becoming operational, this annual spending figure is rising.

• **Electronic components market** for resistors, switches, capacitors, tubes, transformers, etc., at Dayton AF Depot, Gentile AF Station, Dayton, Ohio, amounts to about $100 million a year. Components are used as replacements for operational aircraft and missiles. Funding comes from Air Force operation and maintenance funds rather than obligational authority for new equipment.

CONTRACTS AWARDED

Northrop is awarded a $20-million contract with AMC for the Snark missile, spare parts, technical data, handbooks and bill of materials.

North American receives a $9,099,-998 contract with AMC for research in supersonic environment for Phase I development program for the B-70 bomber.

Teletype Corp. receives a $2,170,-744 contract with CAA for ultra-high speed Teletype equipment in-

cluding selectors, transmitters, tape perforators, switching boards and associated equipment.

Boeing gets a $1,250,000 contract with AMC for KC-135A, type MB-26 flight simulators, spare parts, special tools, installation service data.

United ElectroDynamics is awarded a $1-million production contract with AMC for transistorized telemetry systems to be used on Atlas, Titan and Thor.

Emerson Radio & Phonograph gets four contracts with AMC: $8 million for production of a flight load recorder set which employs a new concept in magnetic recording and provides information on stress loads experienced by airborne vehicles during flight; $300,000 for airborne radar control sets, AN/APW-20, for use on the Martin Mace missiles, TM-76A and TM-76B; $2 million for recording set, data playback, auxiliary test set, engineering and technical data; and $1 million for an advanced radar beacon.

RCA gets contracts with AMC amounting to $3 million for development and production refinement of a computer diode, a power rectifier, a general-purpose transistor and a power transistor. Environmental temperature requirements are: operation at 400 C; case must withstand 600 C. Gallium arsenide and indium phosphide will be used.

Philco will build eight high resolution airborne systems for Army Signal Supply Agency under a $2.5-million contract. Compact enough to be used in most operational aircraft, the radar uses a new signal processing technique known as "REDAP."

Raytheon receives a $497,933 contract with Army Boston Ordnance District for repair parts for the ground-to-air Hawk missile. This procurement will include an estimated 40 percent of subcontracting of electronic components, such as resistors, capacitors, inductances and common hardware.

Precision Components . . . another Kearfott capability.

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Kearfott components for missile and aircraft systems can provide optimum performance at temperatures as high as 200°C. Moreover, this peak performance is unaffected by 2000-cps vibration and 50-G shock. Kearfott's compact, light-weight and corrosion-resistant components provide this consistent record of accuracy:

Synchros: Sizes 8 through 25. Errors as low as 20 seconds from E. Z.

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Servomotors: Sizes 8 through 25. Wound for transistorized amplifiers.

Kearfott research is continually developing even more accurate and more durable components . . . preparing for the needs of tomorrow. For details, write today or contact your nearest Kearfott sales office.

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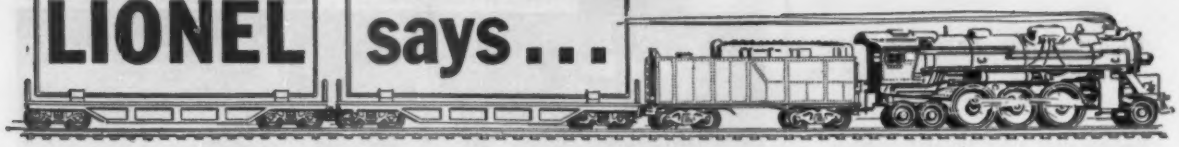
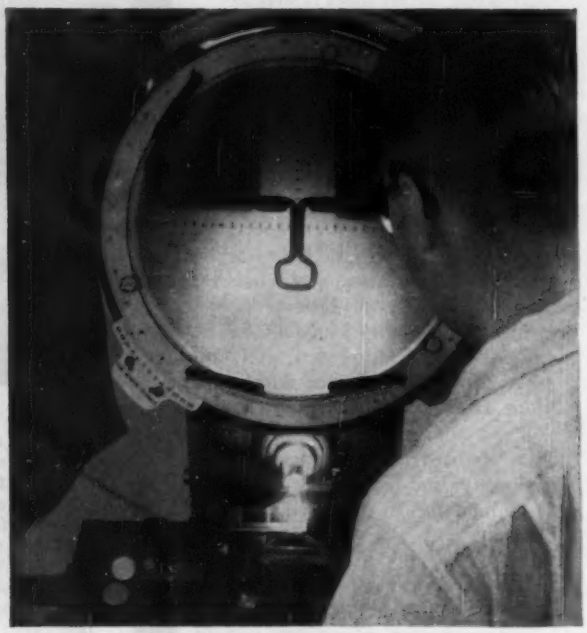
LIONEL says...



"Jones & Lamson Comparators help us make difficult inspection jobs easy. Delicate, intricately-shaped parts are inspected speedily and accurately. Our savings in time and money are substantial."

checking the critical dimensions of an armature commutator



new "T" rail is one of many parts held to very close tolerances

Many manufacturers of mass-produced precision parts and components face these demanding inspection requirements: – *Speed,* to keep pace with production; *Extreme accuracy,* for tolerances as close as .0001"; *Flexibility,* because of variety of parts, and different types of inspections and measurements needed; *Reliability,* for sure quality control; *Ease of operation and maintenance,* for steady day-in, day-out performance.

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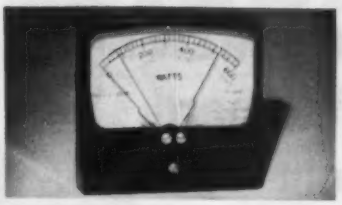
NEW PRODUCTS

Wattmeter locking contact

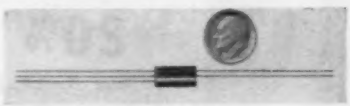
ASSEMBLY PRODUCTS, INC., Chesterland, Ohio. Direct monitoring and control of electrical power by a single instrument is now possible with a new locking contact wattmeter. With the locking feature, high and/or low limits of wattage may be preset, with control action



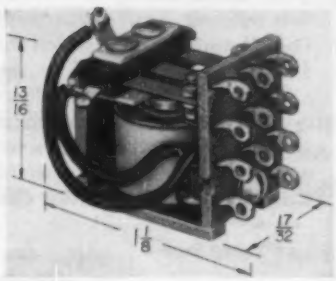
being initiated when a limit is reached. Limits are set by pointers that may be turned easily anywhere on the dial. Control action may be any of a number of forms. In presently available models of the wattmeter, capacity of the field coil ranges from one to 20 amperes a-c. The instruments are calibrated so that with a given amperage limit, watts may be read and controlled on the dial when nominal voltage is 110, 220 or 440 a-c. **Circle 50 on Reader Service Card.**

Tiny Chopper transistorized

SOLID STATE ELECTRONICS CO., 8158 Orion Ave., Van Nuys, Calif. Model 60 transistorized nonmechanical chopper features extremely small size (¼ in. diameter by ½ in. long), and is solidly encapsulated to withstand shocks of 2,000 g for 11 millisec, vibrations of 30 g up to 2,000 cps and acceleration of 5,000 g. It may be used either as a modulator or a demodulator, and being an inertialess device it can be driven from d-c to hundreds of kc, symmetrically, nonsymmetrically or randomly. The switching cir-



cuitry provides stability and freedom from drift over a wide temperature range, −40 C to +80 C. **Circle 51 on Reader Service Card.**

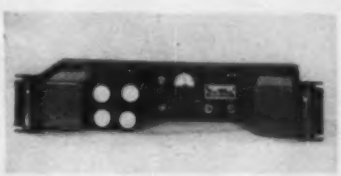


Subminiature Relay armature type

POTTER & BRUMFIELD, INC., Princeton, Ind., has announced a subminature, lightweight, armature type relay for commercial and industrial control applications. The KM relay occupies about 0.5 cu in., weighs ⅛ oz and operates on as little as 750 mw. It provides switching arrangements up to 3 pdt; it switches up to 2 amperes at 115 v 60 cps, resistive loads and provides over a million operations at rated load. A d-c operated relay, it can be furnished for voltages up to 48 v. Some present applications include automatic traffic control systems and automatic weather stations. **Circle 52 on Reader Service Card.**

Power Amplifier timing signal type

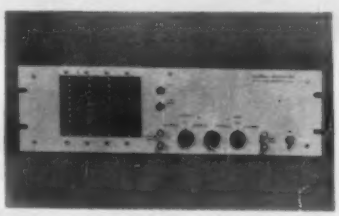
NEMS-CLARKE CO., 919 Jesup Blair Drive, Silver Spring, Md. Type TSA-100 timing signal amplifier is designed for distribution service in data transmission systems. It is a fully transistorized, wide band-



width power amplifier having frequency response from d-c to 50 kc at full output of 5 w, peak. At reduced power output the response extends from d-c to 180 kc. The unit accepts either balanced or unbalanced inputs and amplifies these signals to deliver 5 w into a 150-ohm balanced load. Amplifier has a voltage gain of 82. **Circle 53 on Reader Service Card.**

Counter four display units

AEROTRONIC ASSOCIATES, INC., Concord, N. H. Model 1301 counter is designed for use by the engineer who is primarily concerned with measurements in the audio range from 1 cps to 25 kc. The basic unit includes four multivibrator type digital display units and their associated input and gating amplifiers. Options available include an internal 1 second gate generator (60 cycle line frequency time base), and/or an



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"Our Dynasert machines are currently inserting ½- and 1-watt resistors into printed circuit boards used in Clear Text Monitors. One operator can average 1,000 insertions per hour.

"Our old method produced four boards per man-hour while the Dynasert method produces 20 boards per man hour. The savings in efficiency have more than paid for our machine investment in less than 6 months. Our floor space required was cut 90% for the inserting operations."

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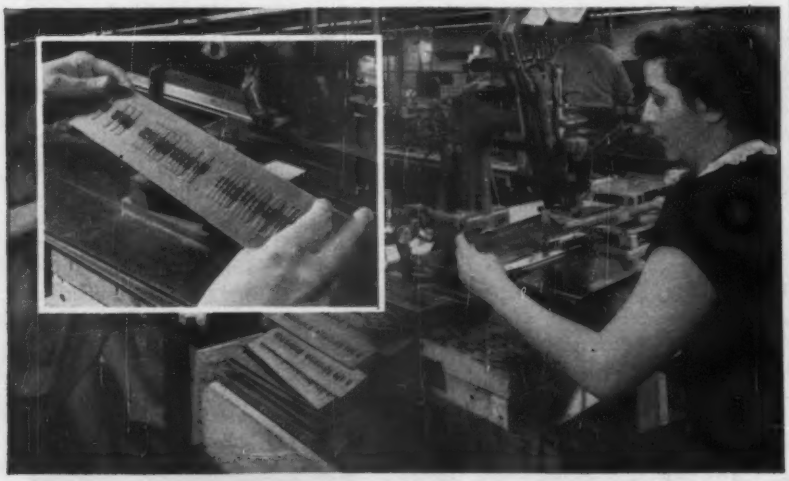
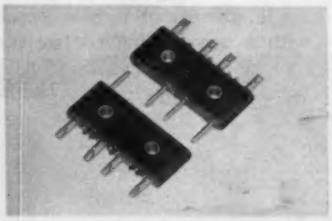


United

SHOE MACHINERY CORPORATION

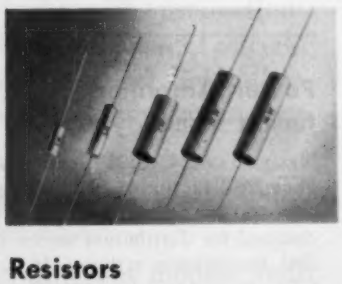
140 FEDERAL STREET, BOSTON, MASSACHUSETTS

internal millisecond time mark generator for measuring pulse widths. Printed circuits are used throughout. Basic counter is priced at $225. **Circle 54 on Reader Service Card.**



Tiny Connectors side mounted

DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y. The new series G miniature rectangular connectors are designed for space-saving side mounting. The reverse pin and socket construction is adaptable to various pin arrangements that accommodate different circuit requirements. Overall width varies from less than ½ in. to approximately ⅞ in., and a thickness of only ⅛ in. to slightly over ¼ in. Side mounting feature also permits stacking of several units for a more compact assembly. **Circle 55 on Reader Service Card.**



Resistors axial-lead type

Sprague Electric Co., 407 Marshall St., North Adams, Mass. An improved all-welded construction, which removes the danger of open resistance elements from cold soldered joints or of melted internal solder connections when resistors are subjected to excessive overload, is a feature of these axial-lead Kool-ohm resistors. The use of ceramic-

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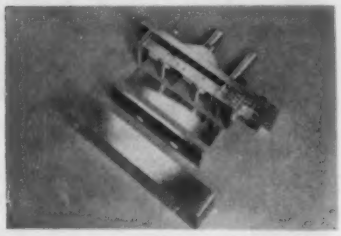
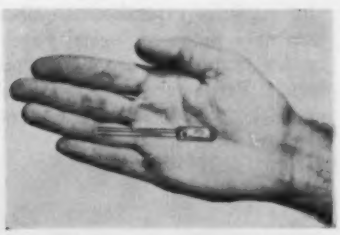
insulated wire permits higher resistance values in a given size than in conventional resistors. Complete performance characteristics are given in engineering bulletin 7300, available on letterhead request.



UHF Amplifiers low noise

Ewen Knight Corp., Needham Heights 94, Mass. The two-stage grounded-grid amplifiers of the EK/LNA series feature low noise figure, excellent r-f shielding and simplified tube replacement. The Western Electric type 6280 coplanar triode is used in a special socket which offers mechanical rigidity, efficient cooling, and one-step disassembly for tube removal. The amplifiers are available with either cavity-type or line-type interstage and output coupling. Amplifiers are also supplied with i-f conversion to 30 or 60 mc. Circle 56 on Reader Service Card.



Trimmer Pot superminiature

Dale Products, Inc., Box 136, Columbus, Neb., announces a new superminiature wire wound trimmer potentiometer, designated the 750, rated at 2 w up to 70 C ambient. Featuring rugged construction and completely sealed case, it is able to meet the most stringent environ-

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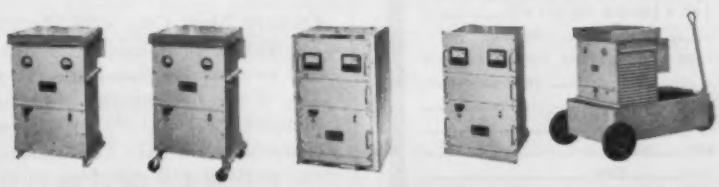

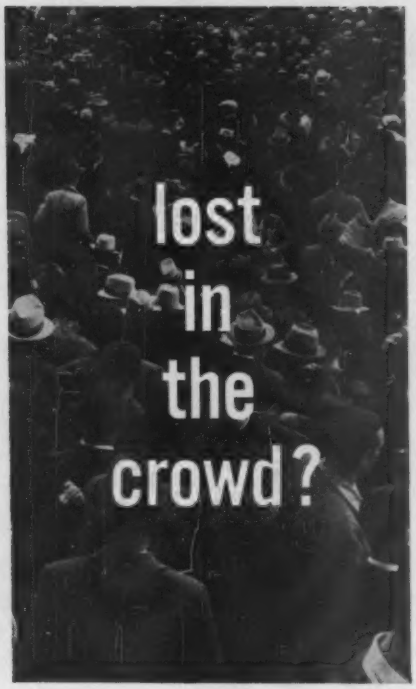

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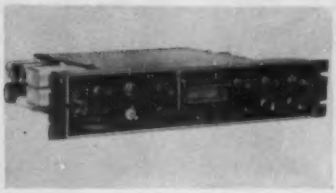
mental conditions. It has an 18 turn trimming screw. Clutch arrangement prevents breakage due to over-excursion. Shaft torque is 5 in./oz maximum. Eleven standard resistance values provide a selection from 100 ohms to 30 K ohms. Standard tolerance is ± 5 percent. Resolution is 0.1 to 1 percent depending on resistance value. **Circle 57 on Reader Service Card.**

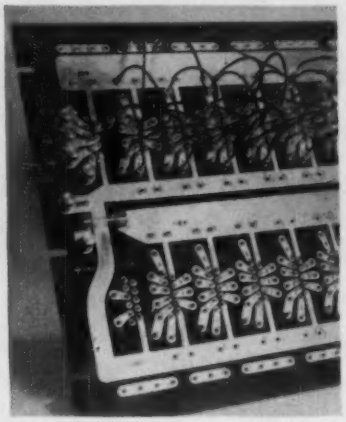


Oscilloscope very compact

THE JAMES MILLEN MFG. CO., INC., Malden, Mass. Model 90923 is a 3¼ in. high rack panel type general purpose oscilloscope utilizing the type 3XP–3 in. by 1½ in. rectangular face tube. New scope has a 2-cps to 30-kc linear sweep. Trace is very sharp and bright due to 2,000 v accelerating potential. Balanced deflection amplifiers: vertical–7 cps to 125 kc ± 2 db, 0.12 v rms per cm; horizontal–2 cps to 125 kc ± 2 db, 0.14 v rms per cm. **Circle 58 on Reader Service Card.**

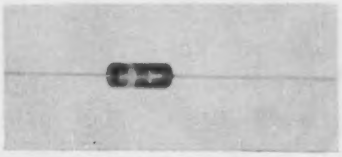
Rheostat miniaturized

OHMITE MFG. CO., 3698 Howard St., Skokie, Ill. Model E rheostat is a unit smaller than many 1- or 2-w, film or composition potentiometers, yet capable of 12½ w dissipation at 40 C. This ceramic and metal unit is only ⅞ in. in diameter, and extends ¼ in. behind the mounting panel. Capable of operation in high ambient temperatures (with proper derating), the unit lends itself to military and aircraft applications. **Circle 59 on Reader Service Card.**



Logic Breadboard magnetic core

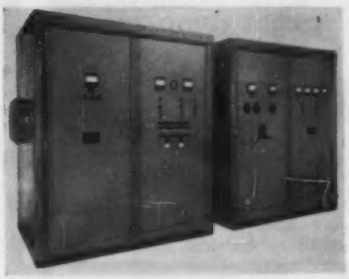
DI-AN CONTROLS, INC., 40 Leon St., Boston, Mass. A new magnetic core logic breadboard consists of up to 23 magnetic core logical elements (CTL-50 or CTL-100) plus drivers on a p-c panel suitable for mounting in a standard 19-in. rack. Dimensions are 19 in. wide, 10¼ in. high and 1¾ in. deep. All logical connections are brought out to plug-in terminals for patch-cord connection. Any desired logical connection can be set up quickly and easily for experimental evaluation of a proposed logical system or for training in magnetic core logic. Patch-cords are supplied with the breadboard. **Circle 60 on Reader Service Card.**



Voltage References two-watt package

TRANSITRON ELECTRONIC CORP., Wakefield, Mass. Silicon voltage

references with low temperature coefficients are available in the axial lead two-watt package. Ideal for limited-space regulator circuits, these units have temperature coefficients as low as 0.001 percent per deg C. They provide a stable reference voltage over the operating range from −55 C to +100 C. Each reference consists of hermetically sealed glass diodes and may be operated in any position without voltage variation. **Circle 61 on Reader Service Card.**



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INTRODUCTION TO ELECTROMAGNETIC ENGINEERING

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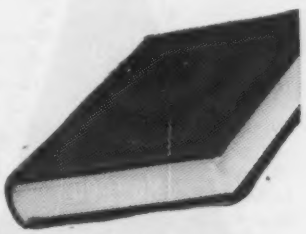

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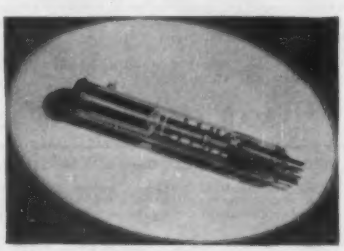

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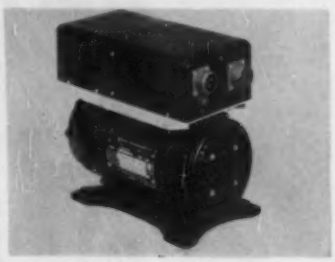

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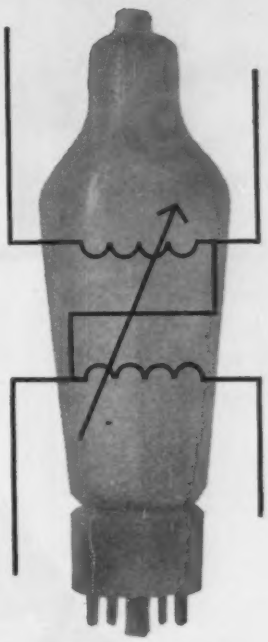

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Literature of the Week

MATERIALS

Hollow Glass Microspheres. Emerson & Cuming, Inc., 869 Washington St., Canton, Mass., announces an 8-page illustrated brochure entitled "Eccospheres". It describes a hollow glass microsphere product which is used as a dielectric material in molding compounds, radomes, heat barriers, foams, casting resins and ceramics. **Circle 85 on Reader Service Card.**

High-Temperature Material. Haynes Stellite Co., Division of Union Carbide Corp., 420 Lexington Ave., New York 17, N. Y. An 8-page booklet discusses a new material—Haynes silicon nitride—designed to operate up to and over 3,000 F in certain atmospheres. **Circle 86 on Reader Service Card.**

COMPONENTS

Stacked Tubes In Glass. Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y. A recent issue of *Engineering Data Service* deals with the type 7244, a medium-mu double triode featuring stacked mount design and frame type and construction. **Circle 87 on Reader Service Card.**

Stereo Cartridge. CBS-Hytron, Parker St., Newburyport, Mass. Bulletin E-289 gives complete specifications, an outline drawing, a frequency response curve, and installation instructions for the Columbia constant displacement stereo cartridge, model SC-1. **Circle 88 on Reader Service Card.**

Tubular Capacitors. General Electric Co., Schenectady 5, N. Y. Bulletin GEC-1518 provides detailed information on the description, operation and application of Lectrofilm-B tubular capacitors. **Circle 89 on Reader Service Card.**

Pressurizing Windows. Bomac Laboratories, Inc., 1 Salem Road, Beverly, Mass. A 6-page folder covers a line of pressurizing windows. Included are specifications on choke flange mounted types, soldered types, and special types. **Circle 90 on Reader Service Card.**

EQUIPMENT

Voltage Limiter. Electronic Measurements Co., Inc., Eatontown, N. J. Specification sheet 3066 covers the model 66 voltage limiter which is used to protect transistors and other voltage-sensitive devices from damage due to voltage transients. **Circle 91 on Reader Service Card.**

Delayed-Pulse Generator. Hewlett-Packard Co., 275 Page Mill Road, Palo Alto, Calif. Volume 9 No. 8 of the *Journal* contains an illustrated technical description of a precision delayed-pulse generator for measuring and generating short time intervals. **Circle 92 on Reader Service Card.**

Transistor Servo Amplifier. Librascope Inc., 808 Western Ave., Glendale 1, Calif. A two-page brochure describes the model 501-1 miniaturized transistor servo amplifier which features ¾ output over a wide range of temperatures. **Circle 93 on Reader Service Card.**

Information Systems. Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio. Field measurements of process variables, made locally and/or remotely, are received and displayed in digital form by the Metrotype information systems, illustrated in new, 8-page bulletin E72-1. **Circle 94 on Reader Service Card.**

FACILITIES

Customized Electronic Equipment. Nuclear Electronics Corp., 2925 N. Broad St., Philadelphia 32, Pa. A recent brochure deals with the company's complete facilities for subcontract work. It contains the complete background of the people who will do the administrative and engineering tasks. **Circle 95 on Reader Service Card.**

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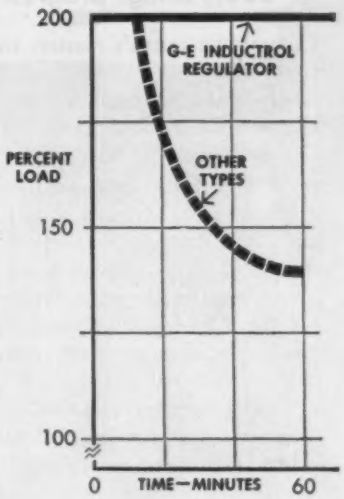

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Red China: A Line on Science

Chinese cite advances in electronics. They say party thinking, not USSR, brings progress

COMMUNIST CHINA's masters are now talking up recent and future "forward leaps" in electronic technology and automation without crediting the Soviet Union.

There appears to have been a switch in the propaganda line lately from praising Soviet assistance to asserting, in a way suggesting that both nationalism and "face" are involved, that "politics must take command in technological and scientific work."

A Mandarin language broadcast recently claimed for the Chinese Communist party the credit for rapid technological strides in the last few years. It said the "Communist style of thinking" rather than a "sudden increase of knowledge and power of the scientists" has been responsible for recent advances.

Just announced by Peiping was the opening of new university of science and technology "to train Communist-minded research workers." The university is under the joint leadership of the Chinese Red academy of sciences and ministry of education. Peiping says the teaching staff includes top men of the academy's institutes of research.

The Chinese Reds say the university will accelerate training of new scientists so that, "within a short period, China will catch up with the advanced nations" in the caliber of scientists. This suggests a stepped up national scientific rivalry with Russia based on Chinese Communist disciplines.

Supporting this thesis is the statement, coincident with the announcement of the opening of the new university, that the teachers and students built an electronic computer plant, an electronic instrument plant and three other factories before the university was opened.

At the same time Peiping reported that program-controlled milling machines were among the new machine tools turned out in September for the first time.

More recently, in the atomic energy area, Peiping made these claims without citing Russian aid:

- Production of "many kinds of counter tubes" to determine the type and intensity of radiation and "counter telescopes for recording the intensity of cosmic rays."
- Production of a 50- and a 100-channel pulse height analyzer which "demonstrates," says Peiping, "that China has mastered the complicated technique of atomic electronics."
- Completion of Red China's first induction electron accelerator, a 5-mev unit, and other accelerators.
- Production of spectrometers for "determining radiation intensity," a millimicrosecond pulse oscilloscope, isotope separators and "other important instruments."
- Production of electron microscopes, the first ever produced in Red China. Program of this plant in Peiping comprises some other items which could not be manufactured in Red China until recently: x-ray apparatus (200 scheduled for this year) and ultrasonic devices. Regular production of transistor devices will reportedly follow soon.

DEVELOPMENTS ABROAD

- **In Britain** a new phosphor compound developed by Ferranti Ltd. permits radar screens to remember images for as long as 20 minutes. Showing of the stored image is controlled by a button; image can be erased or recalled any time during the 20-minute period. System uses phosphors whose luminescence is visible only when infrared light of different wavelengths strikes the radar screen. By beaming these infrared waves, a rapid series of images appears. Ferranti says that with its new phosphors, afterglow is under operator control and can be released at any desired intensity so that no image remains when the next field is presented.

- **Australia's** Commonwealth Scientific and Industrial Research Organization reports development of a transistorized temperature controller that eliminates the failure of instrument components to control variables. Control unit's accuracy is said to be satisfactory as long as certain components do not change; in normal use these parts are said to remain stable almost indefinitely. Controller is already in use to maintain temperature levels in heaters and in other applications.

EXPORTS and IMPORTS

Yugoslavia has just concluded two manufacturing license agreements with electronics firms in the West:

- **Jugoimport,** Yugoslavian import agency, reached an agreement with Marconi of Britain, which permits Yugoslav manufacture of an airborne automatic direction finder. Unit is the AD722, developed for the RAF. British firm will supply parts for assembling, and will give technical assistance to the Yugoslav plant.

- **Yugoslav Foreign Trade Asso-**

ciation has reportedly reached an agreement with Philips under which five Yugoslav plants will assemble Philips tv sets from parts imported from Holland. Yugoslav report says first 1,700 sets will be assembled by the end of the year and that, after several years, Yugoslav plants will also make the parts.

In Tokyo the Soviet trade mission has signed a contract with Toyo Trading Co. for purchase of a $30,000 electron microscope made by the Japan Electronic Industry Research Institute. Toyo says contract is the fourth the Russians have signed for an electron microscope since it was taken off the embargo list in August. Negotiations are said to be underway for Soviet purchase of a new electron microscope with greater magnitude.

In Frankfurt/Main Consolidated Electrodynamics Corp., of Pasadena, Calif., recently formed a subsidiary to look after Consolidated interests in Western Europe and the U. K. Firm hopes to find profitable markets in Europe for its full range of electronic research and industrial instruments.

United Kingdom Treasury and Supply Delegation in the U. S. has awarded a contract to the Avion division of ACF Industries for an undisclosed number of radar beacons. Britain will use the beacons in missile test firings to extend the tracking range of ground radar.

Japanese firm Sanyo Electric Co. is making transistor radios for the Channel Master Corp. under a new agreement which puts the U. S. tv antenna manufacturer into the transistor radio field. Two 6-transistor models are offered initially.

In Britain Solartron Electronic Group will manufacture products of Cohu Electronics of San Diego, Calif., for sale in England and Europe. New license agreement launches international operations for the U. S. firm. Solartron will make Kin Tel amplifiers and digital voltmeters at first, and act as export sales agents for other Cohu products prior to their manufacture by the British firm.

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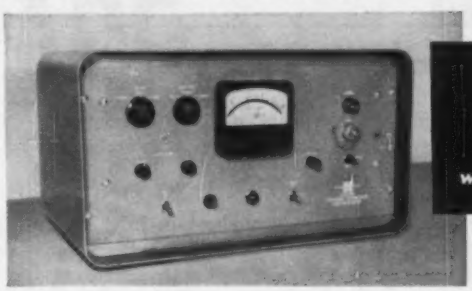

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Broadcast Stereo Increases

Two-channel transmission systems are being developed to expand national stereo interest

FALL DEVELOPMENTS indicate that a-m, f-m and tv broadcasters will bolster public enthusiasm for stereo.

Check this week by ELECTRONICS shows six f-m stations using experimental licenses for stereocasting. FCC says extensions will be granted if results are promising.

Over a dozen companies are making or planning to make f-m stereo adapters. Some will be on dealers' shelves within a few weeks, priced between $50 and $85 by current estimates.

Other manufacturers are waiting for industry standards to be set before considering production.

The Halstead and the Crosby systems have been spoken for by broadcasters in response to FCC request. Commission says the returns have "not yet been analyzed."

Under the Crosby system, broadcasters would use two channels of equal bandwith. Many f-m stations now use their subchannels for providing background music to stores and restaurants, or for some non-broadcast service to paying subscribers. Crosby system supporters say combined public interest in f-m and stereo will allow stations to be self-supporting without secondary income sources.

The Halstead system provides one wideband and two narrow-band information channels in the belief that f-m stations will need additional income for some time.

While f-m stereo standards are being pondered, broadcasters are exploring other means of providing stereo transmissions. Most radio listeners are familiar with a-m/f-m combinations. Broadcasts using radio and tv are also becoming increasingly frequent.

Still in the laboratory stage is a system for a-m/a-m stereo announced this week by RCA. Under this system each of the stereo channels is carried by one of the sidebands of the a-m carrier signal. In the receiver, the sidebands are separated and fed to two speakers. In present a-m receivers, there would be no separation of the sidebands so the transmission would be heard in the conventional fashion without the stereo effect. The laboratory model of the a-m/a-m stereophonic receiver can also pick up nonstereo broadcasts and play them through either or both speakers.

Spokesmen for RCA say that since the system operates in the regular a-m broadcast band it can be used for car radios, which to date have not seen much use of f-m receivers.

No timetable has been posted for commercial development of the a-m/a-m equipment, but RCA hints that "it won't be long" until activity moves out of the laboratory and into the market place.

FCC ACTIONS

• **Changes** rules of Domestic Public Land Mobile Service to permit a base station to be operated as a repeater station, provided the licensee is able to turn the base station on and off at will irrespective of subscriber traffic in the system.

• **Issues** details of meeting between Mexican and U.S. officials regarding uhf tv assignments for stations 200 miles on either side of the border. Information on the agreement is available from the Commission.

• **Files** request from American Medical Association to establish a Physicians' Radio Service using a block of 10 frequencies in the 150-mc band and two frequencies in the 40-mc band on an exclusive basis.

• **Accepts** application from Key Broadcasting, Marathon, Fla., for new broadcast station to operate on 1,300 kc at 500 w; daytime hours, directional antenna.

• **Files** application from Tiger Broadcasting, Baton Rouge, La., for new broadcast station to operate on 1,550 kc, 1 kw; daytime.

• **Grants** permit for a new class A f-m station to Yale Broadcasting, New Haven, Conn., to operate on 94.3 mc, 300 w erp. Station will have permission to close down during Yale University vacations.

STATION MOVES and PLANS

WQXR-FM, New York, requests permission to increase power to 34.1 kw.

WHEW, Riviera Beach, Fla., files application for extension of completion date.

KJAN, Atlantic, Iowa, seeks permission to determine operating power by direct measurement of antenna power.

KUIN, Grants Pass, Ore., plans installation of new transmitter, nighttime directional antenna, and increase in power to 5 kw.

KGMO, Cape Girardeau, Mo., files for c-p to change frequency from

1,220 kc to 1,550 kc, increase power from 250 w to 10 kw, install directional antenna (daytime), install new transmitter.

WFMD-FM, Frederick, Md., requests extension of completion date.

WMTM, Moultrie, Ga., receives renewal of license.

WBNS, Columbus, Ohio, obtains c-p to maintain old licensed transmitters as auxiliary facilities at main transmitter site.

WXFM, Elmwood Park, Ill., is permitted to remain silent for 60 days pending reorganization of facilities.

WNAG, Grenada, Miss., transfers license from B. Imes Jr. to Grenada Broadcasting Co. Inc.

KSIR, Wichita, Kans., receives license for a-m station.

WKMH, Dearborn, Mich., plans increase in nighttime directional antenna system and increase in power.

WTLM-TV, Laurel, Miss., receives extension of completion date to April 20, 1959.

KID-TV, Idaho Falls, Idaho, obtains license covering changes: erp visual 100 kw, aural 50 kw, antenna height 1,600 ft.

WSJV, Elkhart, Ind., plans change from channel 52 to channel 28; erp: visual 204 kw, aural 102 kw; antenna height 690 ft.

KUEN, Wenatchee, Wash., receives license permitting change in frequency to 900 kc, decrease in power to 500 w.

KBUN, Bemidji, Minn., is granted c-p to change antenna-transmitter location, increase antenna height, make changes in ground system.

KFBC, Cheyenne, Wyo., plans installation of new type transmitter as an alternate main transmitter at present main transmitter site.

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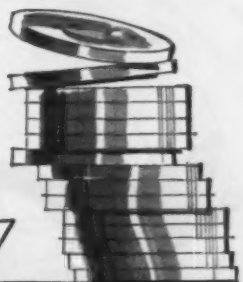

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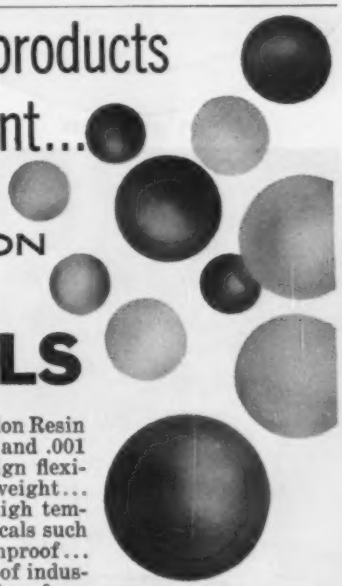

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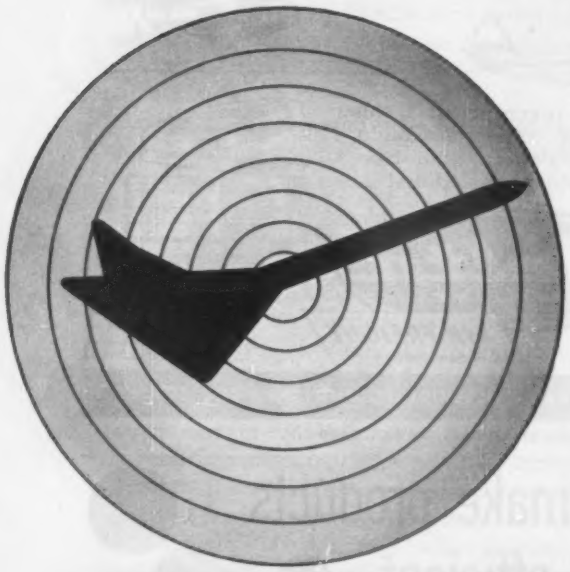
TEST EQUIPMENT ENGINEER John W. Lloyd tells why his work on the B-70 Weapon System at IBM Owego affords him the creative engineering career he always wanted.

WHAT IT'S LIKE TO BE A CREATIVE ENGINEER AT IBM



"Test equipment engineering," says John Lloyd, "is particularly stimulating when it's part of a project as new and important as the B-70, sometimes described as 'a huge flying computer.' Right now I'm coordinating the design of engineering support equipment for an advanced digital airborne computer, part of the B-70's bombing-navigational and missile guidance system. There's a minimum of routine. In order to design test equipment you must know — or learn — about the equipment to be tested; among these are radar, servo systems, digital and analog computers, inertial guidance. I see my professional growth assured as IBM continues to develop computers for airborne applications."

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Raytheon: New Flight Facility

CHARLES F. ADAMS, president of Raytheon Mfg. Co., recently broke ground at Hanscom Field in Bedford, Mass., for the firm's $1.7 million super-modern flight test facility.

Participating in the ceremony was Navy Capt. Willie M. Dickie, First Naval District Inspector General, who represented the Commandant. Pictured behind the pair is an artist's concept of the new structure.

Believed to be the first military flight facility of its kind in the U.S., the new structure will permit the company to reduce the time now needed to run modification and electronic tests on missiles, aircraft equipment and associated units.

The new facility, a 70,000 sq ft structure, is scheduled for completion early next year. It will have about 36,000 sq ft of hangar space to house the dozen planes now used in the company's programs. The remainder of the facility will be devoted to shops and a laboratory. Plans also include adding 22,000 sq ft later, if needed.

Raytheon is prime contractor for the Navy's Sparrow III air-to-air guided missile system.

L.A. Firm Changes Name

COMPUTER EQUIPMENT CORP. is the new name of the company formerly known as Digitron, Inc., Los Angeles, Calif. The name change was effected in order to clarify the nature of the business in which the growing electronic firm is engaged, according to A. C. Bellanca (picture), president.

Actively engaged in the development of advanced hybrid electronic systems since its formation in 1957, the company recently announced the receipt of a contract from Holloman Air Development Center to develop an electronic function plotter.

In addition, the company is working on several electronic machines that subtract binary coded

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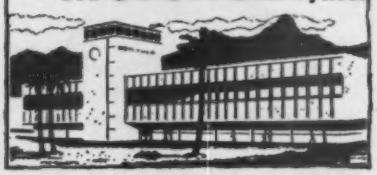

numbers used in digital computing systems, as well as various other projects in the field of electronic computers and instrumentation.

Name N. L. Harvey CBS-Hytron V-P

NORMAN L. HARVEY recently moved from manager of special tube operations for Sylvania in Williamsport, Pa., to vice-president —engineering for CBS-Hytron, Danvers, Mass.

Harvey joined Sylvania in 1941 as a research engineer. Successive promotions led to his appointment as head of the applied research branch in 1948. In 1950 he was made chief engineer of the radio and tv division. His most recent assignment in 1956 made him responsible for engineering, manufacture and sales of magnetrons, klystrons and planar triodes as well as traveling-wave crossed-field, counter, t-r, atr and trigger tubes.

Ling Hires Reid

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Culver City, Calif., is Ray L. Reid.

In his new capacity, Reid will assume direction of a new research and development program on highly advanced vibration testing system components. He will also act as technical consultant to Ling subsidiaries engaged in numerous phases of high-power electronics.

For the past eight years Reid has been with North American Aviation, Downey, Calif., as a test engineer in the fields of electrical and vibration testing, electrical test equipment design and instrumentation for various types of testing systems.

Hanley Named To High Trolex Post

TROLEX Corp., McHenry, Ill., manufacturer of electronic rotary switches and electromechanical devices, has appointed Duncan C. Hanley as vice president and general sales manager.

Hanley was formerly with Grigsby-Allison Co. He joined G-A in 1946 as specifications engineer and for the past three years has been district sales manager. Prior to that he served in the electronics branch of the U.S. Navy and with Sperry Products Co.

Plant Briefs

RCA has acquired the production plant of the Applied Science Corp. of Princeton (ASCOP) for astro-electronic products. Plant is situ-

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Premier Instrument Corp., waveguide manufacturers, recently moved from New York City to a 48,000 sq ft plant in Port Chester, N. Y.

Yonkers Laboratory Supply, now known as **Tenso-Lab, Inc.,** has moved to Irvington-on-Hudson, N. Y. The new quarters represent an increase of over 100 percent in area.

Consolidated Controls Corp. has added a 12,000-sq ft expansion to its plant in Bethel, Conn. Company's products consist in the main of control systems for missiles, aircraft and nuclear power plants.

News of Reps

The line of precision microwave and electronic test equipment, radar system components and high-power modulators manufactured by FXR, Inc., Woodside, N. Y., are being sold in the upper New York State area by **J. D. Ryerson Associates, Inc.** of Syracuse, N. Y.

The **William F. Hemminger Co.,** Miami, Fla., manufacturers' reps, announces the addition of **Everett M. Gordon** to its staff as sales engineer.

Northeastern Engineering, Inc., Manchester, N. H., appoints the following new reps to handle its line of frequency counters, military test equipment and missile components:

Bill Bartleson Co. of Minneapolis, Minn., covering Minnesota, No. Dakota, So. Dakota and northern Wisconsin; **Col-Ins-Co.** of Jacksonville, Fla., covering Florida, Georgia, So. Carolina, No. Carolina, Alabama, Mississippi and Tennessee.

Appointment of the **Gordon V. Peck Co.** as sales rep for the Southwest including Texas, Oklahoma, Arkansas and Louisiana, is announced by Scalectro Corp., Mamaroneck, N. Y.

INDEX TO ADVERTISERS

Ace Plastic Co. 47
Audio Devices Inc. 3

*Barnstead Still & Sterilizer Co., Inc. 8
Beattie-Coleman Inc. 40
Bendix Aviation Corp.
Pacific Div. 38
Scintilla Div. 37
Bruno-New York Industries Corp. 41

Cadillac Associates Corp. 51
*Christie Electric Corp. 37
Cotter Hermon E. 50
*Curtiss-Wright Corp. 45

Delta Air Lines 47
Dow Chemical Co. 42

*Epsco Inc. 19

Food Machinery and Chemical Corp. 3rd Cover

*General Electric Co. 41 43

*Hewlett-Packard Company 4
*Hi-G, Inc. 45
*Hycon Eastern, Inc. 29

*Instruments for Industry 50
International Business Machines Corp 48 51

Jacksonville Chamber of Commerce 40
Jones & Lamson Machine Co. 32

*Kearfott Co., Inc. 31
*Kennedy & Co., D. S. 12

MacDonald Inc., Samuel K. 50
McGraw-Hill Book Co. 39
*Merck & Co., Inc. 7
*Motorola Western, Military Electronics Center 50

*North Electric Co. 22

Oregon Dept. of Planning and Development 49

*Pacific Automation Products, Inc. 9

*Radio Corporation of America ..... 4th Cover
*Raytheon Manufacturing Co. ..... 2nd Cover

Tektronix, Inc. 21
*Trans World Airlines 21
*Tung-Sol Electronic Inc. 10

United Shoe Machinery Co. 34

*Varflex Sales Co., Inc. 11
*Varidney Laboratories, Inc. 50

•

MANUFACTURERS REPRESENTATIVES 50

•

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33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192
193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224

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33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	*22	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192
193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224

Circle No.	Products *

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